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Causal and path model analysis of the organizational characteristics of civil defense system

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Causal and path model analysis of the organizational characteristics of civil defense system

by

Simon Wen-Ion Tai

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CHAPTER I. INTRODUCTION

Why the Organizational Study

It seems quite reasonable to state that each branch of social science deals with a distinctive subject matter. In discussing sociology and other related disciplines, Inkeles (1964) delineates the following branches of social science: Economics which is the study of the production and distribution of goods and services, Political science which deals with political theory and government administration, and Psychology which concerns the mental process, motivation, and personality. He further proposes that the subject matter of sociology is society, institutions (including organizations), and social relationships.

In many past sociological investigations, efforts have been devoted to the empirical study of social relationships using the individual as the unit of analysis. Or, attention has been centered on the theoretical study of the whole society as the unit of analysis. For instance, the study of husband-wife relationships focuses on individuals as units of analysis. The organismic evolution of society or equilibrium theories are some examples of grand theories concerning whole societies as units of analysis. If unit of analysis is used as a criterion to distinguish the level of abstraction of sociological study, then the studies of individuals, organizations, and whole societies may be placed on a continuum of increasing abstraction.

It is the author's opinion that the accumulated knowledge from past empirical researches on social relationships of individuals has provided a base for sociologists to move forward to the study of more complex groups and organizations. The difficulties encountered in developing grand

theories should be an indication that more studies on organizations, which constitute modern society, are needed before using whole societies as units of analysis in sociological study.

As one leading sociologist has suggested:

> Organizations provide a setting within which many basic social processes occur--processes as diverse as socialization, communication, ranking, the formation of norms, deviance, or social control...The study of organizations, then can contribute to the building of social theory by providing descriptive accounts and analytical formulations of generic social processes as they are modified by distinctive structural arrangements. (Scott, 1964: 486.)

The author believes that sociologists should allocate more attention and effort in the study of organizations at the present stage of their discipline. Based on the above rationale, efforts are made in the present study to utilize local civil defense organizations as the unit of analysis.

Conceptual Model and Methodology

In the present study units of analysis are 240 local civil defense organizations sampled from three states of Minnesota, Georgia and Massachusetts. The general framework for empirical analysis was based on Loomis' Processually Articulated Structure Model (P.A.S.M.), which is reviewed in Chapter II in the present study. Following the conceptual model, 57 independent variables and the dependent variable measuring seven civil defense task areas were constructed to indicate the nine elements and five master processes in the PAS model. The empirical data were obtained from interview schedules administrated to the directors of the 240 local civil defense units. Each of the local defense units is conceptualized by the author as a social system.

A social system is an abstract formulation employed by sociologists as an explanatory model in theoretical sociology to deal with the complexity of social phenomena. In this study the term "model" refers to a constructed pattern of relationships to imitate, project or analogously illustrate a pattern of relationships existing in the real world which the investigator observes. Using civil defense organizations, which are special types of social systems, as units of analysis provides several methodological advantages over the use of whole societies as units of analysis. According to David Silverman (1970) organizations seem to have many more clear-cut forms of the characteristics of social systems than whole societies. Illustrations of these differences include the following: (1) organizations appear to have relatively more obvious goals than do societies; (2) the chart of an organization's hierarchy is usually available for the understanding of its structure but there is no parallel guide to the way in which the component parts of a society are differentiated; and (3) the interaction and relationships among organizations are more readily observable than when using societies as units of analysis.

Factor analysis, regression procedures, and path analysis were used in the analysis of the empirical data and testing of models. Factor analysis, a method of analyzing the intercorrelations among a set of measures, was used first to ascertain the existence of a general variable for the construction of an index representing the dependent variable of goal attainment. In the application of regression procedures, three predictive models were constructed based on three different frameworks or model specifications. The first model was a completely specified model developed from available sociological theory or past research results from the substantive fields.

In the completely specified model the number of variables and their relationships are predetermined by the researcher before the model is subjected to statistical analysis. The second model is called "incompletely specified model" and involves the use of preliminary tests of significance. In this model, the author made only a few assumptions, derived from organizational theory and verified knowledge about the organization variables and then applied statistical methods to empirical data to determine the final model. Thus, the incompletely specified model is a combination of theory and statistical methods in model building. The last model was obtained by using stepwise regression procedures to achieve the minimum residual sum of squares for the dependent variable. The last model was determined, without using any theoretical or past research knowledge from sociology after initial determination of variables, on the basis of a statistical procedure along with its selection criteria. Thus, three different regression procedures were used to test an appropriate model and search for the best set of variables and best regression equations. The results of the regression analyses were compared with each other.

Path analysis is a research technique used to analyze a set of related variables based on theoretical knowledge and estimate coefficients for the finalized model. This causal model is heuristic in explaining and/or predicting the social phenomena under study.

In view of the above discussions, the first general objective of the dissertation include the integration of existing organization theory and apply it to the study of civil defense systems and to apply factor analysis, regression and path procedures to the empirical analysis of structural characteristics of civil defense organizations.

Past Civil Defense Studies and the Uniqueness of the Present Study

The empirical data analyzed in the present study was obtained in 1965. A series of sociological studies has been carried out and published based on the analysis of the empirical data since the completion of field work in 1965. The first publication is the 1966 research monograph: "Prediction of local civil defense directors' role performance" by Klonglan, et al (1966). The study summarized the procedures of collecting data, score distribution of each variable, and used single variable analysis and multiple regression approaches to analyze the 57 variables of original data. Another study under the title of "Causal model analysis of local coordinator's building roles in community and complex organizational systems" by Schmitz (1971) utilized axiomatic theories and path model to analyze 12 variables chosen from the original 57 variables. In comparing these past studies with the present study, one obvious distinction is found in methodology. The author of the present dissertation applies factor analysis to test the homogenity of the scores of official goal attainment, uses path analysis to analyze a theoretically formulated causal model involving only eight organizational characteristics (concepts), and makes use of three regression procedures to study three different model specifications involving 14 variables selected from the original 57 variables. In addition to these differences in the use of research methods, the most important distinction between these past studies and the present study falls on the conceptualization of subject matter. In these past studies the directors of the 240 local civil defense offices were conceptualized as change agents and were the focus of analysis, while the present study analyzes the structural characteristics of these local civil defense organizations. More

specifically, the unit of analysis in the present study is organization, in contrast to the past study where the unit of analysis was the individual. Because of the differences in unit of analysis, conceptual model, theories applied, variables utilized and investigated, approaches in data analysis and generations of findings are completely different. For example, there were 14 independent variables in Schmitz's causal model but only eight variables are included in the theoretically formulated path model in the present study. Moreover, distinctions exist not only in the number of variables included but more important is the distinction between the variables themselves. One striking distinction is in the concept of facility. Schmitz used "hours per week on civil defense job" as the empirical indicator of the "facility" that a local director employed to achieve his goal. This thesis uses "budget for local civil defense area" as the empirical indicator of the "facility" with which a local civil defense organization accomplishes its organizational goal or goals. Because of these distinctions in conceptualization, model and approaches, number of variables involved and different variables analyzed, and in the unit of analysis, the author believes the present study is unique and should contribute to the study of organizations.

Importance of the Research Problem

An advanced, industrialized society consists of numbers of "complex" organizations that characterize modern life. Modern individual is born in an organization called "hospital," trained and educated in schools which are also a type of organization, each works and earns a living in a variety of economic organizations, and spends most of his leisure time in certain recreational clubs that are considered another type or organization. It

seems appropriate to term modern society as organization society, a term which appears in Presthus' book (Presthus, 1965). As a student of sociology, the author is interested in understanding and explaining social phenomena and considers the study of any one type of organization to be a worthwhile task and a contribution to sociology and the theory of organizations.

Among those organizations existing in a community or city, the local civil defense organization can be regarded as a special type of governmental organization. In view of these, the third general objective of the dissertation is to establish a causal model based on the structural characteristics of local civil defense organizations and to understand and explain the variability of these organizations in achieving their official goals. In addition to explanation and understanding, the causal model may be quite informative and effective in promoting civil defense organizations' official goal attainment based on the knowledge of the explaining variables, which are some of the important structural characteristics for the civil defense organizations.

Research Objectives

In accordance with the two general objectives, specific research objectives delineated for this study are:

1. To study the existing theory of organizations in order to define those structural characteristics related to the concepts of organizational goal attainment, and to formulate a theoretical causal model in explaining and/or predicting the official goal attainment.

2. To operationalize the structural characteristics and goal attainment of civil defense systems into empirical variables such that the statistical analysis and testing of the causal model and regression models is made possible.
3. To discuss the application of factor analysis in sociological measurement, and use it to test the existence of an index measuring official goal attainment of local civil defense systems.
4. To apply path analysis as discussed in the methodological chapter to the development of path models, comparison of path coefficients, and to test paths in the derived model.
5. To introduce the frameworks of completely specified versus incompletely specified regression models in the organizational study, and to apply forward, backward, and stepwise regression procedures to the above two types of regression models.
6. To compare and evaluate the results obtained from analyzing the various models to determine a final model or models which integrate the existing organizational theory and the findings of the empirical analysis.

CHAPTER II. REVIEW OF ORGANIZATION THEORY AND CAUSATION

The emphasis in this chapter will be on the reviews of several types of organizational theories, especially those related to the structural characteristics and the attainment of organizational goal(s). In addition, the notion of causality will be discussed to provide understanding of the development of causal models in latter chapters. It is an important task to review literature since existing sociological theory guides a researcher in formulating his conceptual model about his subject and/or sociological phenomena under study. The conceptual model derived under the guidance of theory will influence the selection of research methods in analyzing empirical data, and in turn, the result of data analysis will provide evidence which can be used to improve the sociological theory.

The Definition of Organization

The term "organization" may have different meanings to different sociologists: for example, (1) some sociologists view organization as social system through which the group members can achieve their common goal, and (2) some others consider organization as a division of labor in which specialized activities are carried out by different members and are coordinated with activities of other specialists. However, the term "organization" will be refered to in this dissertation as an abbreviation of "formal organization" or "complex organization" which is usually conceived as one special type of social organization.

Many attempts have been made by organizational theorists to define "formal organization" yet no general agreement has been reached. "Formal

organization" is defined in terms of organization goals by some leading sociologists such as Udy (1965) and Parsons (1963). Some sociologists conceive the formality in social relation of organization members as the defining characteristic and others attempt to establish the defining features of formal organizations in terms of the type of integration, such as their relative internal specialization and goal consensus. Each of these definitions offer insights but also has some limitations in perspectives. For instance, the original stated goal of an organization may be changed over time, and the member's or leader's goal may not be identical with the goal of an organization such that it creates some difficulties in defining organizations in terms of their goals. However, it is the author's opinion that although the definition based on the organization's goals may have some risks, many leading theorists of organizations prefer the definition any many sociological analyses on formal organizations have followed this lead.

Blau and Scott (1963:1) state "formal organizations have been established for the explicit purpose of achieving certain goals." Parsons (1963) suggests that primacy of orientation to organizational goal attainment be used as the defining characteristics in distinguishing an organization from other types of social system. His definition is "an organization is a system which, as the attainment of its goal, produces an identifiable something which can be utilized in some way by another system..." (Parsons, 1963:17). Following Parsons' idea, Phillips (1969:116) states "the organization is a social system which is deliberately constructed and reconstructed to seek specific goals or values." The present author prefers the definition of

organization in terms of organizational goals and will use the Phillips definition in referring to the general class of the unit of analysis (civil defense organizations) in the dissertation.

Theory of Organizations

It is the author's opinion that there exists no single, widely accepted theory of organizations at this stage of the discipline. However, what the author will try to review are some general, conceptual frameworks, developed by leading sociologists, focusing on some perspectives of formal organizations. Since the author conceptualizes the local civil defense organizations as a social system, and the variables designated in obtaining empirical data were originally centered on the Loomis processually articulated structural model, literature related to organization as system will be reviewed first. Along this line some commonly used approaches in the study of organizations will be discussed and related to the research framework used in the dissertation.

The emergence of formal organizations is in part a consequence of the division of labor or the degree of differentiation in a society. In addition to the differentiation, Eisenstadt (1958) outlines some other important conditions for the development of modern organizations: (1) allocation of the crucial roles on the basis of universalistic rather than particularistic criteria; (2) the boundaries of the community extend beyond the limit of any particularistic group; (3) a greater complexity of social life; (4) groups in a society attempt to develop and to pursue goals in the area of political, economic, and social service, and the boundaries of these goals extend beyond any given particularistic group; and (5) the

development of differences among groups with regard to the priority of goals and competition among them for scarce resources.

Some of the main assumptions underlying the view that an organization is a system are: (1) organizations are composed of a set of interdependent parts, each part contributes to and receives something from this interdependence; (2) the relations between parts are relatively stable and durable; (3) organizations have needs for survival, and goal attainment of an organization is only one of these needs; (4) organizations, conceived as social systems, must behave and take action. Since, if organizations have needs, then they may be presumed to take action in order to satisfy those needs.

Three questions seem to predominate in the work of system theorists. These are the nature of the inter-relation of social systems, the contribution of the inter-relation to the effectiveness or survival of the whole system, and the process and nature of system dynamics. Silverman elaborates these three areas as follows:

> (1) The first task of the system theorist is to determine the nature of the relationships between the assortment of systems and sub-systems that he chooses to distinguish. The concepts of input, throughput and output can be used to trace the flow of tangible and intangible objects...(2) the system theorist asks how satisfactory any given pattern of relationships is in terms of the needs of the organization as a whole...(3) System theorists are divided over the forces which make organizations change and which influence the direction which change takes. According to the more traditional view, the needs of the system as a whole, especially the need for survival, shape the actions of system parts...The system is presumed to evolve as a whole in the direction of greater internal consistency, and to have a spontaneous tendency towards homeostasis--or self-stabilization in the face of outside threats to its survival. (Silverman, 1970:30.)

In discussing the relationship between a system and its environment, Silverman (1970) further suggests three distinctive types in his framework:

closed, partially-open, and open. Underlying the closed system viewpoint is the positivist assumption that objective factors exert a direct influence upon human behavior. The view of a partially-open system holds that it is sometimes best to give prior attention to organizational variables to limit the scope of organizations study. The open system framework introduces the environment--physical or social--into organizational analysis in order to justify the idea of the system as a whole and to explain the organizational behavior in terms of the environmental influence.

Viewing an organization as a system, Parsons (1960) claims any specified goal of an organization is a specialized or differentiated function of the larger system of which the organization is a differentiated part of subsystem. Based on this viewpoint, organization's goal(s) can be viewed as the primary link between an organization and the larger system such as whole society in which the organization is a part, and provides a basis for the typological scheme of organizations. Furthermore, the structure of any organization can be analyzed in terms of value pattern since it defines the basic orientation of the organization to the situation in which it operates, and it provides the guides to the activities of the organization's members. According to Parsons' conceptual model, all social systems are confronted by four universal problems--adaptation, goal-attainment, integration, and pattern-maintenance or latency. In the case of organizations, the adaptive problems concern mobilization of fluid resources such as land, labor, and capital; goal attainment pertains to the utilization of these fluid resources to achieve organizational goals; integration refers to the types of norms which commit the individual to the organization; and

pattern-maintenance problems have to do with legitimizing the activities of the organization for its members and the general public. Thus, organizations can be distinguished from other social systems in terms of emphasis given to the organizational goal attainment.

As mentioned in the introductory chapter, Loomis' processually articulated structural model was employed as "an ideal type" in designating empirical variables in the 1966 civil defense study. The author would like to review the nine elements, six master processes and three conditions in the PAS model. The elements are: (1) Belief (knowledge)--belief is any statement or proposition about reality which is regarded as true. (2) Sentiments--sentiments are those expressive feelings, including attitudes that the members of a social system feel about reality. (3) Ends, goals or objectives--the elements are those changes that the members of a social system attempt to accomplish through the operation of the social system. (4) Norms--norms are rules or standards of behavior defined by the shared expectation of members of a social system prescribing what is acceptable or unacceptable behavior. (5) Status-role (positions)--this is what a social system expects from an incumbent in any social position in a given situation. (6) Rank--rank is the relative position of a member in a given social system. (7) Power--power is the capacity to manipulate, control or influence the behavior of others. The element includes two major types of controls; that is, "authority" and "influence." (8) Sanctions--sanctions are the rewards or penalties directed at a member or members of the social system to discourage or encourage certain types of behavior with regard to both ends and means. (9) Facility--facilities are the means utilized by a social system to achieve its ends or goals. The six master processes in the PAS

model are as follows: (1) Communication--communication is the process in which the members of a social system exchange meaningful symbols. (2) Boundary maintenance is the process in which a social system originates, builds and maintains its coherence, identity and interacting patterns. (3) Systemic Linkage--this is the process by which a social system relates itself to another system and interacts with that other system such that in some way these related social systems function as a single system. (4) Socialization--socialization is the process whereby a social system's value orientations, expectations and role requirements are transmitted to new or old members. (5) Institutionalization--this is the process which produces and shapes internal consistency to other elements and other processes of the social system such that members' behaviors are patterned and predictable, and (6) Social control--social control is the process in which behavior which deviated from the system's norms is regulated. In addition to these elements and processes there are three conditions for social actions delineated in the PAS model. These conditions are : (1) territoriality--this refers to the physical area in which the action of a social system takes place; (2) size--size is the number of members within a system's territory, and (3) time--which is the temporal span that system's members interact with each other.

To sum up the review of literature at this point, the term "organization" is used as the abbreviation for formal or complex organization, and is defined as a social system which is deliberately constructed and reconstructed to seek specific goals or values. The author prefers to think of an organization as a system, Some assumptions underlying this viewpoint

are that organizations have a set of relatively stable parts or subunits, relationships among parts are somewhat durable, and organizations have survival needs and can take actions to achieve these needs. In discussing the relationships between system and its environment, three frameworks, viewing organizations as closed, partially-open and open system, are reviewed. Another alternative in conceptualizing organizational structure is provided by Parsons whose conceptual model claims that all social systems are confronted by the four universal problems of adaptation, goal attainment, integration and pattern-maintence. In the final part of reviewing social systems, the nine elements, six master processes and three conditions delineated in the Loomis PAS model are discussed since it was an "ideal type" in designating empirical variables in the 1966 civil defense study, and some of these elements, process and conditions are included in the present study.

In the following pages the author would like to review some theoretical orientations prevailing in the discipline toward the analysis of organizations. These orientations provide different guides for empirical researchers, and account for the different methodological perspectives and tools utilized in empirical investigation.

Silverman (1970) discusses five leading approaches of organizational analysis, all emphasizing system problems. He argues that a larger proportion of organizational analysis has been concerned with the explanation of the impersonal mechanisms through which organizations secure their stability. These five approaches include: The Human Relations, Organizational psychology, Socio-Technical systems, Decision-making theory, and structural-functionalism which is the only school derived from a sociological frame of

reference. Following Silverman's idea, the author reconstructs the outline for these five approaches to the study of organizations in Table II-1.

Scott (1964) classified three levels of organizational analysis determined by the nature of the dependent variable under study, by whether the explained sociological phenomena is the behavior of individual members, the functioning of some particular aspect or aspects of organizational structure, or the actions of the formal organization viewed as a total entity. He labels these three levels as: (1) behavioral--the study of member's behavior within the context of the organization; (2) structural--the study of structural features and social processes that characterize organization. This perspective of the investigation may focus on the subunits that comprise the organization, examples are work groups, departments, or examination of certain analytical variables such as specialization, communication, etc.; and (3) ecological--the study of the organization as a subsystem or subunit in a larger system of relations. Although the identification of these three levels is somewhat arbitrary, the perspective that the author utilizes in the present study to analyze the civil defense system should be regarded as the structural in the above three classifications. Scott (1964) further discusses three possible foci of attention in the structural analysis of organizations. These are: (1) viewing organizations as instruments for the attainment of specified goals, and putting emphasis on the rationality of the structure; (2) considering the organization as a goal-directed structure, and the specific goals pursued will determine the important characteristics of the structure; (3) regarding the organization as a social system, the preservation of the system becomes an end in itself.

Table 2.1. Five leading approaches to the analysis of organization*

Approach	Leading Scholars	Major Concepts	Underlying Assumptions	Orientation to Environment	Choice of Major Problem
Human Relations	Roethlisberger, Dickson, Mayo	Social Man, informal Org.	Social man as seeking satisfaction by workgroups' membership and committed to his workgroups.	Organization usually considered in a vacuum.	The satisfaction of the workgroup in order to attain managerial goals.
Organizational Psychology	Argyris, Likert, Maslow	Self-Actualizing Man, Complex Man (man's motives may vary according to situation), Needs	A hierarchy of personality of needs (physiological needs, safety needs, social needs, self-actualization). Self-actualization is an important motivating factor.	Organizations as open system--emphasis on the importance of personalities.	The degree of compatibility between the needs of the personality and of the system.
Socio-Technical System	Trist, Rice, Emery	Task systems & Sentient system	The impact of technology and market demands upon organizational form.	Organization as open system--emphasis on the relation of environment to implementation of primary task of the organization.	The efficient performance of a primary task in relation to the demands of technology, the environment and the members.

*Original sources: David Silverman's book "Theory of Organizations" p. 217.

Table 2.1. (continued)

Approach	Leading Scholars	Major Concepts	Underlying Assumptions	Orientation to Environment	Choice of Major Problem
Decision-Making Theory	Simon, March, Cyert	Administrative man	Man as a decision-maker and problem-solver. The language of a computer program is a conceptual tool.	Organization as open system--considering environment limits rationality of decision-making.	The nature of the decision-making process in relation to the stability and growth of organizations.
Structural-Functionalism	Selznick, Parsons	Dynamic equilibrium, open-system	The dynamic equilibrium of system which adjust to threats to their survival.	Organizations as open system--viewing environment as a source of problems and of resources.	The nature of the interdependence of social systems.

To sum up the present review of organizational analysis, the five analytical approaches of "the human relation," "organizational psychology," "social-technical system," "decision-making theory" and "structural-functionalism" were discussed and summarized in Table 2.1. The approach appropriate to the present study is structural-functionalism. In addition, the three levels of organizational analysis classified by Scott were introduced. The three levels are behavioral, structural, and ecological; of these, structural analysis was employed by the author to study the 240 local civil defense organizations. Moreover, the author conceives the structure of civil defense organizations as goal-directed in the early development of these organizations. However, it is in the present study that the civil defense organizations are considered by the author as on-going systems, so that certain structural characteristics of these organizations are conceptualized as the explaining forces of the goal attainment of the organizations.

Since the structural characteristics of organizations are the main foci of organizational analysis in the present study, the review of literature will turn to this aspect. In analyzing the structural characteristics of the typical, big organization, Presthus (1962) observes the following characteristics: large size, specialization, hierarchy, status, authority, oligarchy, co-optation, rationality, and efficiency. The size of organization refers to the number of members which is large enough to prohibit face-to-face relations among most participants, and there is a negative correlation between size and morale. Low productivity and absenteeism are also associated with organizational size. Specialization was important in achieving greater productivity in industrial organizations.

Hierarchy is the ranked positions in an organization along a descending scale from the top to the bottom. Closely articulated with hierarchy in big organizations is the status system. Status refers to the allocation of different amounts of authority, income, rights, and privileges associated with each position in the organization's hierarchy. Moreover, oligarchy means "rule by the few" or the power of the few over the many, but it does not mean that the majority is powerless. Co-optation is the process in which the organization's elite select their successors, which is important in enhancing organizational discipline and continuity. Another important characteristic of formal organizations is the capacity for objective, intelligent action which is referred to by Presthus as rationality. In conclusion, these above structural characteristics constitute the bureaucratic model which is an ideal type for all big, large scale organizations.

Hage and Aiken (1970) discuss seven organizational characteristics of complexity, centralization, formalization, stratification, morale, rate of production, and efficiency that affect the eighth organizational characteristic of the rate of program change. Their definitions (Hage and Aiken, 1970:33-53) of these characteristics are:

> Program change is the addition of new services or products, complexity is the level of knowledge and expertise in an organization, centralization is the way in which power is distributed in any organization, formalization refers to the degree of codification of jobs in an organization, stratification refers to the differential distribution of rewards to the jobs in an organization, production is the relative emphasis on the quantity or quality of the organization's products or services, efficienty refers to the relative emphasis on the cost reduction of the product or service, and job satisfaction (morale) is the degree of morale among the job occupants in the organization.

Hage and Aiken (1970:33-53) further propose the following hypotheses about these organizational characteristics with regards to the program change:

1. The greater the complexity, the greater the rate of program change
2. the higher the centralization, the lower the rate of program change
3. the greater the formalization, the lower the rate of program change
4. the greater the stratification, the lower the rate of program change
5. the higher the volume of production, the lower the rate of program change
6. the greater the emphasis on efficiency, the lower the rate of program change
7. the higher the job satisfaction, the greater the rate of program change.

Scott (1964) argues that organizations having specific objectives or goals tend to be associated with relatively centralized authority structure, be less concerned with member's participation, and put less emphasis on maintaining internal communication channels than those organizations having diffuse goals. Moreover, the nature of an organization's goal in part defines the process of goal implementation, and division of labor within an organization depends in part on techniques required by the task.

In sum, the review of literature has introduced and discussed three different levels or aspects of organizational studies. These levels are: those organizational theories available for the guidance of conceptualization, approaches used in analyzing organizations under study, and structural characteristics of a formal organization in formulating empirical variables. Those theories conceptualizing organizations as systems were the center of the theoretical review. Those analytical approaches or frameworks related to analyze organizations in terms of system problems and those structural characteristics relevant to the characteristics of local civil defense organizations were the main emphasis in the above review.

Causal Thinking in Sociology

It is interesting to note that there are two contrasting viewpoints on the notion of causality among sociologists. Some sociologists, following David Hume's idea that we can observe or perceive no causation and hence no valid empirical basis to demonstrate it, denies the usefulness of the concept to the understanding of sociological phenomena and its application to sociological analysis. Other sociologists, like MacIver (1942), defend the concept and continue to use it.

Since it is not the author's intention to get into a philosophical discussion of causality, the above two viewpoints will not be argued. Instead, emphasis will be on what some leading sociologists think about the concept and what they have proposed in dealing with cause and effect relationships empirically. Based on Rhoads' article (1971), causal thinking will be reviewed from several theoretical perspectives.

Auguste Comte, a representative of the positivist viewpoint, claimed that the concept of causality is a continuation of the experiencing mind and therefore, has only an epistemological status. Excluding the study of causation from the subject matter of sociology, Comte proposed that the major task of sociologists is to discover law which states invariable relations of succession and likeness between events (Comte, 1905:22). G. A. Lundberg, an empiricist, designates the notion of cause and effect as a special case of animistic and theological thinking (Lundberg, 1939:260) and proposes a social science based strictly on analyzing the association of observable social phenomena. System theorists, such as Parsons and Homans, maintain that, since traditional notions of causation imply an asymmetrical

relationship from a single cause to a single effect, traditional causality is too restrictive a concept to handle the interdependence and interaction among system's parts (Parsons, 1965; Homans, 1950).

In defending the notion of causality, MacIver (1942:68) argues that

> the concept of causation is derived from experience, the primary experience of living in an environment. It is the concept of a primary relationship, so that, even if we regard it as illusory, we cannot analyze the concept itself into any simpler one.

Thus he rejected Mead's definition of causation "The relation of any event to the conditions under which it occurs is what we term causation" (Mead, 1938:33).

MacIver (1942) also suggested three axioms of causation as follows: axiom 1 asserts that whatever happens has a cause; axiom 2 states that where there is difference in the effect there is a difference in the cause; axiom 3 is that every cause is the effect of a prior cause and every effect is the cause of a posterior effect. In sum, MacIver's idea is that the study of cause and effect would result in better understanding and interpretation of social change, and thus would advance social science to a higher level.

The development of probabilistic models of contemporary statistics reformulates the concept of causality and provides a more realistic description of social phenomena. In introducing Sorokin's causal thinking, Rhoads (1971:23) argues that

> in Sorokin's view the historic concept of causality and the idea of change are inconsistent principles, and it follows, therefore, that the task of the sociologist is to employ a different strategy (probabilistic model) to investigate socio-cultural phenomena than the uncovering of cause-and-effect relationships.

Rhoads further discusses two variants of causal thinking from the conceptualist's perspective. The first suggests than "only the language of mathematics, especially differential equations, is capable of grasping and describing the complexity of interacting variables...The tendency is to substitute mathematical functions for objective causal bonds, although it is also a question of which conceptual scheme provides a better fit to the factual world" (Rhoads, 1971:29). The second variant of the conceptualist's causal thinking, which will be our main emphasis in the following discussion, conceives cause and effect as an attribute of the conceptual model itself. Thus, "causal relationships can be ascertained by subjecting the model to logical or mathematical operations. Definitions of the term 'cause' combined with the application of logical rules determine the existence of cause-and-effect relationships rather than the empirical study of the facts to which the propositions in the model infer" (Rhoads, 1971:29). This is the principle idea in the Simon-Blalock causal model.

Simon-Blalock Causal Ordering

Simon (1957) proposes to answer the question of whether we should use the term "cause" in the language of science in terms of whether it is meaningful to assert that the relationship between variables in a model is an asymmetrical or symmetrical one. His own answer to the question is affirmative. In order to provide a clear and rigorous basis for determining the existence of a causal ordering between two variables or groups of variables in a model, Simon (1957:12) made two preliminary remarks: (1) "The concepts to be defined all refer to a model--a system of equations--and not to the 'real' world the model purports to describe." (2) Though "cause

could be defined as functional relationship in conjunction with sequence in time." But Simon argues that "causation does not imply time sequence, nor does time sequence imply causation." Then he goes on to show that, "given a system of equations and a set of variables appearing in these equations, we can introduce an asymmetrical relationship among individual equations and variables that corresponds to our common-sense notion of a causal ordering" (Simon, 1957:12). In doing so, Simon first established the following two important definitions concerning the concept of endogenous and exogenous variables and causal dependence between variables. These two definitions are the gist of Simon's causal thinking.

Definition of Endogenous and Exogenous Variable: If D is a complete subset of order k, and if a variable x_i appears in D but in no complete subset of order lower than k, then x_i is endogenous in the subset D. If x_i appears in D but also in some complete subset of order lower than k, then x_i is exogenous in the subset D. (Simon, 1957:18)

Definition of Causal Dependence on Variables: Let b' (beta) designate the set of variables endogenous to a complete subset B, and let r designate the set endogenous to a complete subset C. Then the variables of r are directly causally dependent on the variables of b' (b' $\longrightarrow$ r) if at least one member of b' appears as an exogenous variables in C. We can say also that the subset of equations B has direct precedence over the subset C. (Simon, 1957:18)

Note that in the above two paragraphs, the lower letters refer to a set of variables and the capital letters refer to a system of equations.

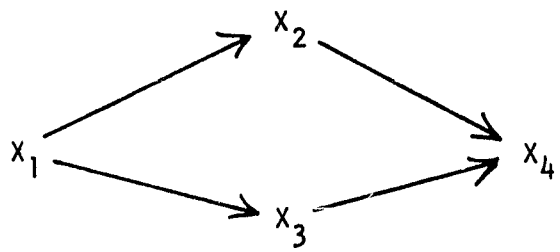
Following Simon's idea, Blalock (1964) suggests conceptualization of the notion of causation in simpler models having a finite number of variables. After a specific set of variables has been selected based on theory from substantive field or prior knoweldge, an investigator can make the model either completely deterministic or probabilistic by whether or not the error terms are introduced. However, in order to make the causal model more realistic or in keeping with a real-world counterpart, Blalock prefers a probabilistic model utilizing regression analysis to trace the mean value in the endogenous variable for each value of exogenous variables. Under the assumption that outside variables have no systematic effects on the relationship between the endogenous variable X and the exogenous variable Y, and all other variables explicitly included in the causal model have been controlled, he defines "direct and indirect causes" by saying that "X is a direct cause of Y if and only if a change in X produces a change in the mean value of Y" (Blalock, 1964:19) and "X is an indirect cause of another variable Z if and only if we can find a subset of variables U, V, ..., W, all of which have been explicitly included in the model, such that $X \rightarrow U \rightarrow V \ldots \rightarrow W \rightarrow Z$" (Blalock, 1964:20). The variables U, V, and W, standing intermediate in a causal sequence between an initial or antecedent cause and the final effect Z, are referred to as intervening variables. Blalock further proposed to make use of recursive systems, a subclass of simultaneous equations, to formulate asymmetrical causal relationships between variables in the model. The recursive system of equations, plus certain assumptions about the error terms, allows us to make predictions about the magnitudes of correlation and regression coefficients. In evaluating a causal model,

Blalock argues that under the least square method the appearance of a partial regression coefficient is equivalent to the disappearance of the comparable partial correlation. So that if a particular partial slope is assumed to be zero, it gives the interpretation of no direct causal link between the two variables concerned, though there may be indirect linkages through other variables in the model (Blalock, 1964:64-65). The author will discuss in more detail the empirical testing of the Simon-Blalock causal model in later chapters.

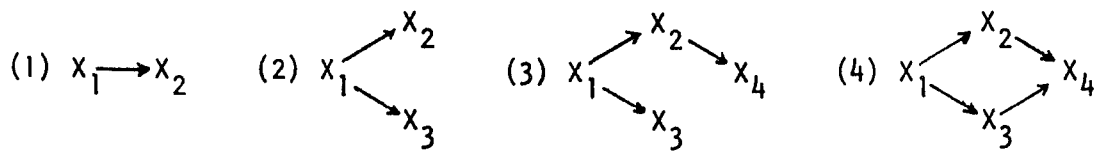
CHAPTER III. FORMULATION OF CONCEPTS AND CONCEPTUAL MODELS

In the present chapter the author identifies and defines fifteen concepts relevant to the structural characteristics of civil defense organizations, and then develops a theoretical causal model based on the author's conceptualization about the causal orderings between these concepts.

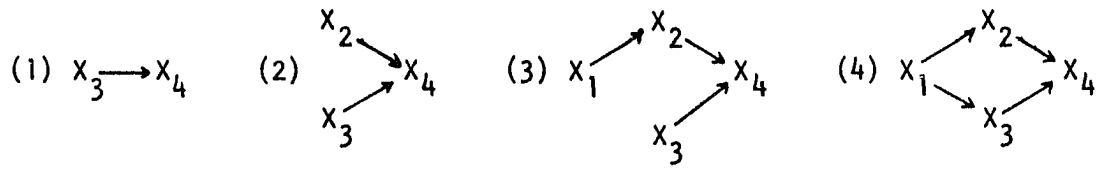
There are two different procedures in formulating causal models; the author will call them forward formulation and backward formulation procedure. The difference between these two is that the forward procedure starts with an exogenous variable and looks into their cause and effect relationships with endogenous (dependent) variables successively, and the backward formulation procedure begins with the dependent variable in the model and works backward to its exogenous variables. To illustrate the difference, assume there are three independent variables X_1, X_2, X_3, in which X_1 is the only exogenous variable, and a dependent variable X_4. Assume further the causal model is:



In the process of formulating the above model, the forward procedure breaks into the following four distinctive steps:



The backward procedure breaks into the following four steps:



The author shall use the backward formulation procedure to develop the general causal model since the procedure begins with the dependent variable X_4 and the dependent variable appears in each of the successive steps. This provides a more clear picture with regards to the dependent variable and its cause and effect relationships to other variables in the model.

The Dependent Variable

Goal attainment of civil defense organizations

Parsons (1960) defines the organization as a social system which is deliberately constructed and reconstructed to seek specific goals or values. Goal attainment of an organization is a relation between a social system and the relevant parts of the external situation in which it acts or operates. In the present study each civil defense organization can be viewed as a social system seeking its goals. An organizational goal is a state of affairs or situation which does not exist at present but is intended to be brought into existence in the future by the activities of the organization Warner (1967a:5). More briefly, a goal of an organization is an intended state, as distinguished from an actual or presently existing state. The definition of organization by Parsons and the definition of the organizational goal by Warner are congruent in that they view organizations as ongoing systems tending to attain a desired state or situation in the future

through conscious and rational control of organization's efforts. Note that the word "on-going system" is the main emphasis in the above paragraph, since once an organization is established, it will continuously be in search of satisfying means or solutions to achieve the endless organizational goal or goals.

Parsons (1966:7) has further theorized that every social system must solve four universal functional problems to survive, to be effective. These four problems are as follows: (1) the maintenance of the highest controlling patterns of the system; (2) the internal integration of the system; (3) the system's orientation to the goal attainment in relation to its environment; and (4) the adaptation of the system to broad conditions of the environment --such as non-action, physical environment. The above four problems are commonly referred to as GAIL model, that is goal attainment, adaptation, integration, and latent pattern maintenance. The process of adaptation has to do with the problem of obtaining human and material resources for achieving organization goals. Integration is related to the process and problem of accomplishing an adequate level of solidarity and coherence among inter-units or subsystems. Pattern maintenance concerns those processes of harmonizing tension among participants and developing participants, commitment to organizational goals. Finally, goal attainment refers to the mobilization of organizational resources for the achievement of organizational goal. The last part of the above discussion is the main concern in the dissertation and the goal attainment of civil defense systems is the organizational phenomena to be explained.

Two general models or approaches in studying organizations has been delineated by Etzioni (1964:16). The first approach is the goal-model which

considers success as a complete or at least a substantial realization of the organizational goal. The second is the system model approach which constitutes a statement about relationships that must exist for an organization to operate. The latter approach emphasizes the comparative analysis of organization, and it can be subdivided into two major sub-types of system model: 1) one is called a survival model, that is, a set of requirements which, if fulfilled, allows the system to exist, and 2) the other sub-type of the system model is an effectiveness model which defines a pattern of interrelations among the elements of the system that would make organizations more effective in the achieving of given goals. Following the above discussion the author tries to integrate these two approaches into the present study. That is, the approach used in the dissertation is the combination of goal comparison and system analysis of local civil defense organizations using goal attainment as the dependent variable.

Goal attainment of a local civil defense organization is viewed in the dissertation as the degree to which civil defense official goals, in terms of task areas, are accomplished. Seven task areas were stated in an official document called the program paper. These seven task areas include: 1) licensing, marking and stocking of eligible buildings, 2) direction and control consisting of two subtasks--establishing an emergency operating center and arranging for the use of emergency radio communication systems, 3) establishing a basic operational survival plan, 4) training and public education, 5) public information activities, 6) emergency services I--warning services and radiological defense service, 7) emergency service II--assigning other emergency services to other individuals and agencies in the community.

A general level of causal model based on sociological theory and past researches will be formulated later in this chapter. The causal chains among nine structural characteristics of local civil defense organizations and their effects on goal attainment will be discussed and constructed into the general causal model. As mentioned in the preceding section only the backward procedures will be utilized in the dissertation in order that the dependent variable and those independent variables discussed in preceding steps will appear each time in the causal network at successive steps.

The empirical model testing will make use of the data collected during 1965 of civil defense organizations in three states--Georgia, Massachusetts and Minnesota. The operational definition and measurement of the goal attainment and the nine organizational characteristics included in the causal model, and six additional variables related to the civil defense organization will be elaborated in a latter chapter.

The Independent Variables

Interorganizational relations

Interorganizational relations are defined as the interdependence among complex organizations on the basis of resources need (Aiken and Hage, 1968: 912-915). There are two different viewpoints about interorganizational relationship as Aldrich (1970:1) suggests: (1) considers the concept as those relations between subparts of organizations in a community--in this respect interorganizational relations are relations between "intra" system or subunits; and (2) refers the concept of interorganizational relations to those relations between a particular organization or

social unit and other social units--in this respect the concepts are those relations between systems or units. The second viewpoint of the interorganizational relation is employed in the dissertation since each local civil defense organization is considered as a unit of analysis.

Two distinctive types of interorganizational relations are classified by Aldrich (1970:5) as follows: (1) institutional relations which are based on common values and understandings, examples of this kind are domain consensus, overlapping boards and committees; (2) operational relations or control-maintaining activities which are upon complementarities in task, examples of this kind include information exchange, referrals, and shared resources of various kind in joint projects or activities.

Since interorganizational relations between a local civil defense organization and other organizations are cooperative in nature, it is quite reasonable to assume these cooperative relations have beneficial effects upon goal attainment or the performance of civil defense organizations. Thus, the author asserts the existence of a cause and effect relationship from interorganizational relations to goal attainment of civil defense organization, that is, the more the interorganizational relations the higher the goal attainment. Empirical supports of the assumption can be found in several writers: Warren (1967) and Reid (1964) state in their journal articles that efficient use of resources among organizations results in better organizational performance. Cumming (1968) has shown how such relations may also be conceived of as a system of control over deviants.

Following the above assumption, the author establishes the first causal chain between interorganizational relations and goal attainment in the

general causal model being developed. The first cause and effect relationship is diagrammed as follows:

Interorganization relations ⟶ Goal attainment

Figure 3.1. The first variable affecting goal attainment

Intraorganizational coordination

Coordination, according to Price (1972), is the degree to which each of the various interdependent parts of a social system operates according to the requirements of other parts and of the total system. Hage (1971:860) defines "coordination as the degree to which there are adequate linkages among organizational parts." However, intraorganizational coordination is conceptualized in the dissertation as the orderly arrangement of group effort, to provide unity of action in the pursuit of a common purpose. This is in accordance with James Mooney's definition (1947:5).

Thompson (1967:56) discusses three practices to achieve coordination within an organization, that is, coordination by standardization, coordination by plan, and coordination by adjustment. It is generally assumed that an organization having better coordination will produce concerted action to attain organizational goals.

Georgopoulos and Mann (1962) in a study of 12 general hospitals view coordination as those organizational processes through which functionally interdependent parts and activities in the system are articulated with one another so as to ensure the system will operate effectively. They further distinguish effectiveness and coordination by saying that effectiveness is something about how well an organization is doing in achieving its objectives while coordination is something about the articulation of diverse

organizational parts and functions. Thus coordination is an intervening variable between specific processes which promote "articulation" and "effectiveness." It is proposed in the dissertation that the greater the number of these processes, the greater the coordination is likely to be; and the greater the coordination, the greater the goal attainment of civil defense organizations.

Based on the above discussion a causal chain between coordination and goal attainment is established in the causal model. By combining this causal ordering and the previous one, we have the following causal network of three variables:

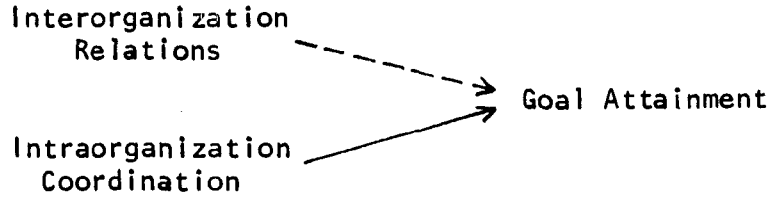


Figure 3.2. The first two variables affecting goal attainment

Note that the dotted line indicates the causal chain established in proceeding step.

Institutionalization

Institutionalization refers to the degree to which the decisions of a social system are supported by its environment (Price, 1968:47-48). Hage and Aiken (1970:71) consider environment as anything external to the organization. In the case of civil defense system, the environment includes local, state, and federal governmental units, other non-political organizations, social and physical conditions where the organization is located. Based on the definition, it is assumed that activities taken by an

organization having high degree of institutionalization receives more support from its environment, and in turn, this support from its environment results in better interorganizational relations, and a high degree of goal attainment. Based on this reasoning the proposed two cause and effect relationships are: (1) the higher the institutionalization, the greater the goal attainment of the organization; (2) the higher the institutionalization, the better the interorganizational relations. The empirical results found in Selznick's study of the Tennessee Valley Authority (1953:29-39) and Clark's study of San Jose Junior College (1960) give evidence that organizations receiving more supports from their environment tend to have better interorganizational relations, and have a higher goal achievement.

In view of the above propositions and previous causal network, the causal model of four variables are shown in the following diagram:

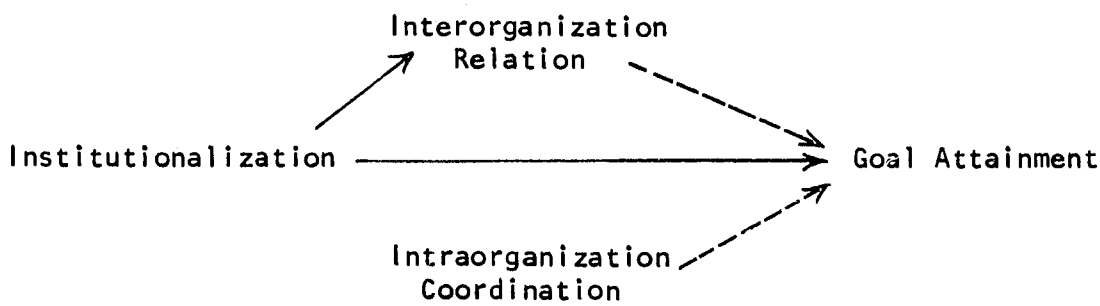


Figure 3.3. The cause and effect relationships of the first four variables Note that the dotted lines are causal relations established in previous steps.

Communication

Communication is the process by which information, decisions, and directives are transmitted among actors and the ways in which knowledge,

opinions, and attitudes are formed or modified by interaction (Warner, 1959, and Loomis, 1960:30).

Price (1968:167-183) summarizes four types of communication as follows:

(1) Vertical communication and horizontal communications: vertical communication is the transmission of information in the superordinate-subordinate relationship while horizontal communication is the transmission of information among peers.
(2) Personal and impersonal communication: personal communication refers to the transmission of information by face-to-face interaction and impersonal communication is the transmission of information by means other than face-to-face interaction. The basic criteria in defining these two is whether the information is transmitted in situations where mutual influence is possible or not during the process.
(3) Formal and informal communication: these two kinds of communication may be defined separately as the official and unofficial transmission of information.
(4) Instrumental and expressive communication: Instrumental communication may be defined as the transmission of cognitive information while expressive communication may be defined as the transmission of normative and affective information.

However, the author prefers to conceptualize the concept in terms of internal and external communication since personnel in the civil defense organizations have to pass up and down a tremendous amount of information as well as in and out of its organizational system. Efficient internal communication ensures a maximum function of the organization system, and sufficient external communication generates concerted organizational effort in attaining goals.

Price (1968:163) states that organizations having better communication are more likely to have greater goal attainment. Following Price's statement, the cause and effect relationship between communication and goal attainment is postulated.

On the other hand, the result of Georgopoulos and Mann's (1962) study of 12 community general hospitals shows that a high degree of communication resulted in the increase of the other 13 variables. Some of the 13 variables are clarity of norms, sharedness of expectations, cooperation, conflicts, openness of communication channels, working together to solve problems, adequate communication from top executives to the professional staff, adequate explanation of work decision, etc. The author further proposes that the increase in communication not only results in a better understanding of organization's decision-making and obtaining more support from its environment but also produces better interorganization relations and intraorganizational coordination.

Thus, following the preceding discussion, the improvement of organizational communication is a cause that influences the variable of institutionalization, interorganizational relation, intraorganization coordination, and goal attainment. If these cause and effect relationships are put into the last causal model, the resultant diagram is:

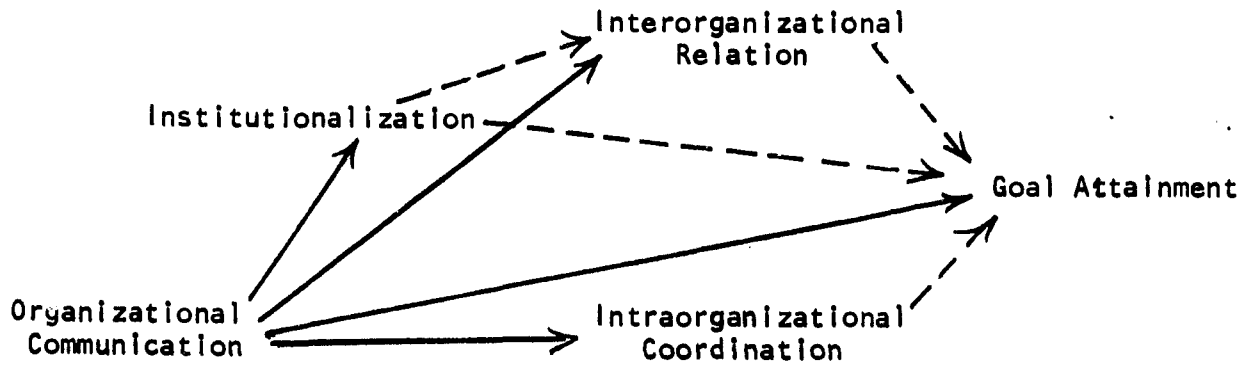


Figure 3.4. The first four variables affecting goal attainment

Note the dotted lines indicate the cause and effect relationship between variables that was established in previous steps.

Representation

Representation refers to "the practice of a social system's members joining other social systems with the goal of increasing its institutionalization" (Price, 1968:116). Recall that the variable of institutionalization is the degree to which an organization's decisions are supported by its environment. Representation, by definition, aims to increase institutionalization of organizations. It can be inferred that the more the representation the more the institutionalization of an organization. Further, the more an organization's personnel establishes their membership in other organizations, the more the communication channels between the organization and others will open up, and the more communication channels will result in better communication. Thus, a cause and effect relationship is established between representation and communication.

However, representation so defined will not include all instances of joint memberships because most individuals associated with a particular organization also participate in many other organizations' programs or activities without intending to increase the institutionalization of his original organization. On the other hand, representation differs with co-optation since organizational co-optation refers to bringing individuals into an organization from its environment while representation is the practice of those individuals from an organization going into the environment.

On the basis of the research results of Warner and Louis (1947), Price proposes the hypothesis that organizations which have a high degree of representation are more likely to have a high degree of "goal attainment" than organizations which have a low degree of representation.

Following the above discussion, it is hypothesized that the cause and effect relationships from representation to the variables of communication, institutionalization, interorganizational relations, and goal attainment. The following scheme indicates the causal model of the first six variables:

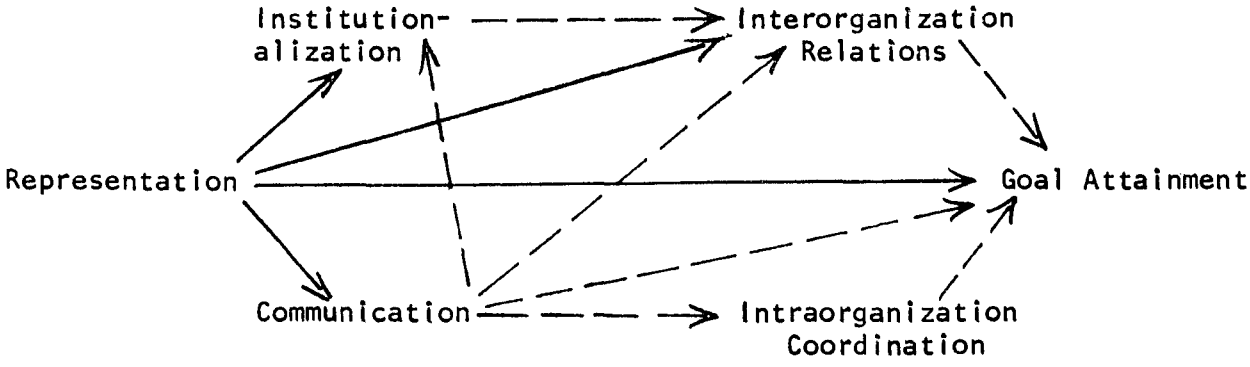


Figure 3.5. The first five variables affecting Goal Attainment

Complexity

Organizational complexity, as defined by Merton and Nisbet (1961:517-520) is the degree of knowledge and skill required to produce the output of a system. An alternative perspective for defining organizational complexity is provided by Hage and Aiken (1970:32-33). They think the complexity of an organization is defined in terms of the level of knowledge and expertise in the organization. The number of occupational specialialities in an organization and the degree of professionalism of each are two complementary aspects of organizational complexity. Thus, the longer the period of training, whether formal or informal, for a position, the greater the organizational complexity, and the more the number of professionalized positions in an organization, the greater the organizational complexity.

Their studies of the effect of structural characteristics of an organization on program change show that the greater the complexity the higher the rate of program change. The empirical evidence of the above hypotheses can be found in a series of studies of school systems under the direction of Paul Mott at Teachers College, Columbia University (Ross, 1958).

The author employed Hage and Aiken's definition of organization complexity with slight modification to the case of local civil defense organizations. Since the task of all local civil defense organizations are quite similar with each other, the degree of professionalization required by each position in the civil defense organization does not differ too much. The possible difference would be the formal or informal training in the area of civil defense knowledge or skills. Based on these arguments, the amount of formal or informal civil defense training would be a better index of the variable.

In the case of civil defense system, a larger amount of civil defense training of the organization's members results in a better communication and intraorganizational coordination within the system due to the improvement of civil defense knowledge and skills. Moreover, a large amount of civil defense training received by the director or official personnel enable the organization to accomplish organizational goals more efficiently and effectively, and gain more support from its environment.

Based on the above discussion of the variable of complexity, four causal relationships from complexity to institutionalization, communication, coordination and goal attainment were established. The following causal

scheme shows the cause and effect relationship among the variables discussed up to this point:

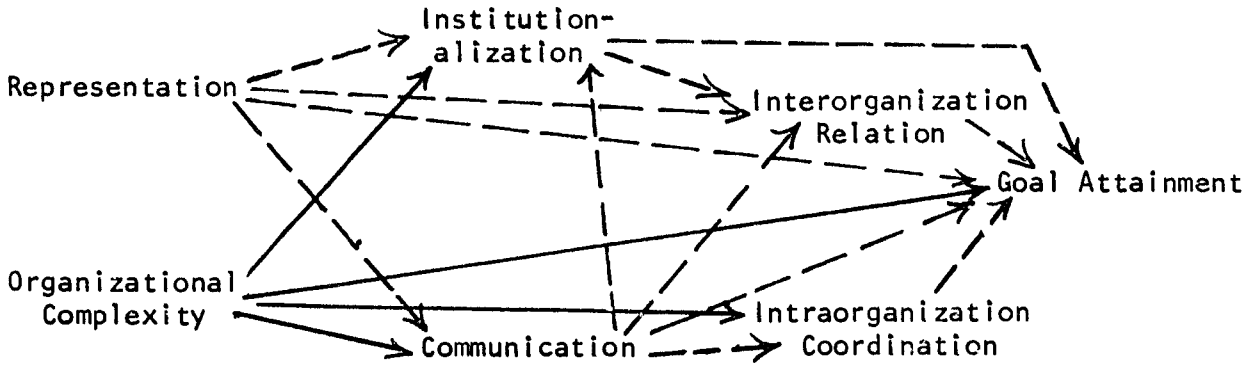


Figure 3.6. The causal model of seven variables.

Size

Sorokin (1947) defined size as the number of human agents of the system. The size of a social system is a primary condition of social action and is not controlled by the actors of the system. Size is one of the important elements responsible for the power of a system. The above definition differs with the literature in the study of economic systems. The size of a productive system usually refers to the volume of output produced and distributed by the system. In this sense the size of an organization can be controlled by the administrators of the system. Thus, the empirical index of size of an economical system has many dimensions, including the organization's scale of operations, volume of work, extent of capital resources, number of clients or customers, and the geographical scope of its activities (Presthus, 1962:28).

In the case of civil defense systems, the size of the population within the local civil defense area is an important factor in civil defense

program planning and activities since protection of each person within the area is the primary concern and goal of the civil defense operations. Thus, the author defines the size of a local civil defense organization as the number of persons covered by the local civil defense program.

To identify the causal relation of size to other variables in the study, the most obvious result of increasing the size of population within a system is the effect on the pattern of communication channels among its parts. Mott (1965:49) discusses the size and the interaction patterns. The following table shows the size of an organization and the potential number of relationships among its parts or members:

Size	2	3	4	5	6	7
Interaction Channels	1	4	11	26	57	120

As one may observe by looking at this table, as size increases the interaction channels or relationships among the actors increase rapidly. Thus, the author hypothesizes that the size of an organization and communication have a cause and effect relationship--the larger the size of an organization the more the complexity of communication. Empirical evidence of the above hypotheses can be found in James' (1951:474-477) study of small group interaction and Bales' studies of various groups where the number of actors of the groups was controlled in a laboratory setting.

The present author further hypothesizes that the size of an organization is directly related to organizational complexity since a civil defense organization having large client population size needs more physical

resources and skillful and well trained personnel to execute its program, furthermore the organization with larger client population has greater potential for the selection of personnel. Note that complexity in this thesis is measured by the level of knowledge and expertise in an organization.

Mott (1965:64) argues that as the population of a social system increases the need for coordination also increases since the increase in the organizational size not only leads to a larger number of communication channels but also results in more divisions or parts within the social system. The more the parts within the system the more the need for coordination in order to keep the organization functioning effectively and efficiently.

Based on the above discussion, the author proposes that size of an organization is causally related to the organizational complexity, communication, and intraorganizational coordination. Thus, the following diagram represents these cause and effect relationships among the eight variables discussed:

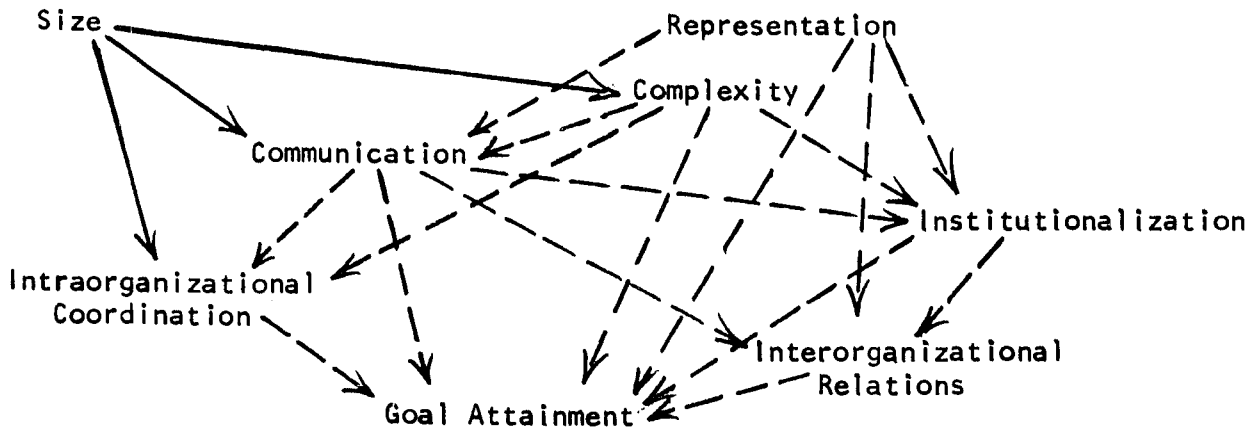


Figure 3.7. The causal model of the first eight variables

Facility

A facility (Loomis, 1960:27) is "a means used to attain ends (goals) within the system." The variable defined in this way may include all resources, such as financial, equipment, individual humans, physical and social resources, available to the organization. In the case of civil defense organizations, the most common means sued to achieve goals include financial resources, staff's social relationships and their activities. Since each local civil defense organization is considered as a unit of analysis, the quality of equipment used, number of persons hired and organizational expenses are all dependent on the budget of the particular organization. The financial resources are the primary means for an organization to achieve its goal or goals.

By the above arguments the author hypothesizes that the organizational facilities and goal attainment have a cause and effect relationship since the application of better facilities (money) enables the organization to have better performance. That is, the better the facilities an organization has, the more effectively the organization attains its goal. Furthermore, a causal relationship between facilities and complexity can be established considering better facilities in terms of larger amounts of budget. The better financial condition will allow an organization to employ more well educated personnel and also provide more opportunities to train its personnel. In consequence, the organizational complexity will be increased.

On the other hand, organizations having larger budgets [illegible] (money), can conduct more organization activities for its members or other organizations to participate in, and make more funds available to support

programs conducted by other organizations. Because of these cooperative activites and programs, it is reasonable to think that better facilities in an organization have beneficial effects on interorganizational relations. In addition, a local civil defense organization having better facilities can afford to use and/or buy luxurious and better communication equipment and to bear the expense of more effective and more efficient "communication systems."

Following the above discussion, the author hypothesizes that the variable of facilities is one of the direct causes acting on goal attainment, interorganizational relations, organizational complexity, and organizational communication. The following diagram represents a complete set of causal relationships including nine variables:

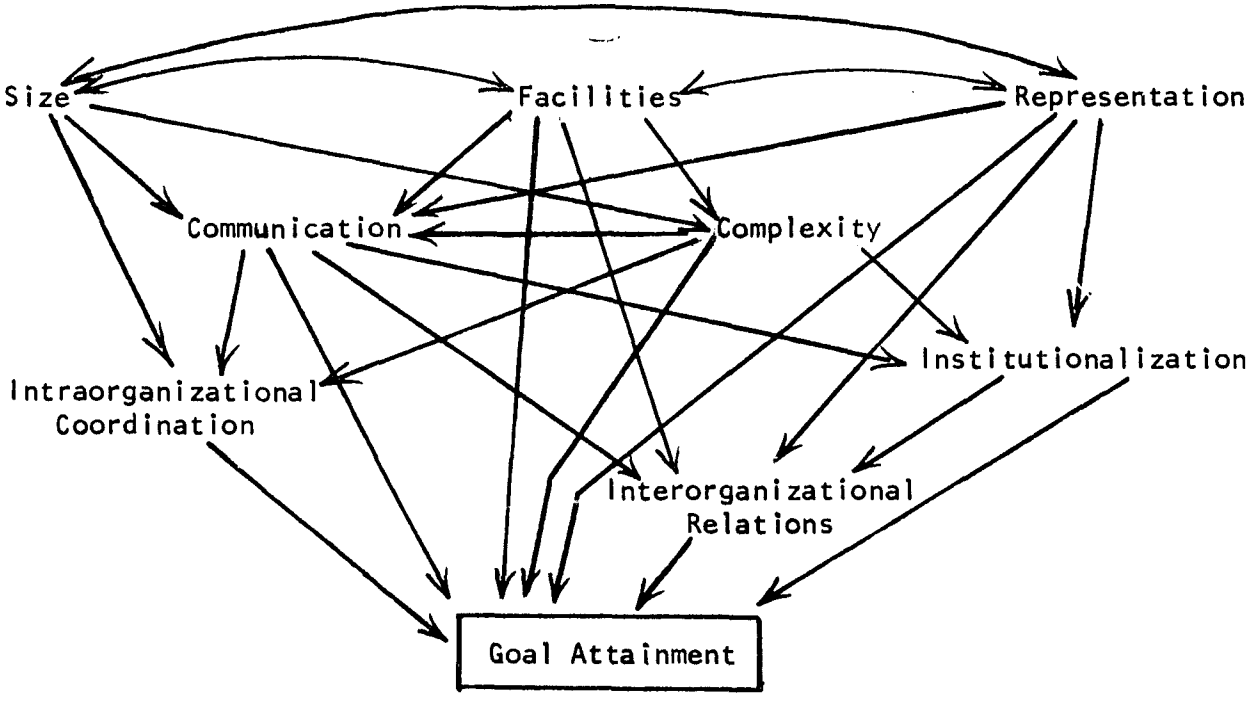


Figure 3.8. The completely specified causal model of eight variables affecting goal attainment

Note in the system of causally related variables that the variable of size, representation, and facilities are considered exogenous variables. That is, these variables are determined only by variables outside of the above causal model. However, the author asserts that these variables are correlated with each other. Thus the two-headed arrows are placed between these three variables.

Additional Variables for Linear Regression Model Buildings

In addition to the nine organizational variables included in the above complete set of causal models, there are six other variables that are needed for later analysis in developing and testing the incompletely specified linear model and completely unspecified linear regression model. These six variables are all related to the social psychology of organizations for which the author feels reluctant to specify their causal ordering with the nine organizational variables related to structural characteristics of civil defense organizations. The six variables are norms, morale, sanction, selectivity, socialization, and ecology.

Norms

Norms (Klonglan and Beal, et al., 1966:17) are defined as the social system's rules (written or unwritten) which prescribe what is acceptable and unacceptable behavior. In a real situation norms are more inclusive than written rules, regulations, and laws; they refer to all criteria for judging the character or conduct of both individual and group actions in any social systems. Loomis (1960:17) states "the concept of norms constitutes the standard determining what is right and wrong, appropriate and inappropriate, just and unjust, good and bad in social relationships."

In the case of civil defense organizations, the most important norms should include those standards or written rules prescribed by the civil defense bureaucracy for local civil defense units' programs and activities. Since no data are available to indicate the number of these standards and/or rules, and no data are available to measure the degree of norm conformity of each local civil defense organization, the author conceptualizes "the understanding of rules" as the empirical index of norms. The variable is not specified in the causal model due to lack of existing organizational theory and empirical knowledge about its effects on other variables in the above causal model. However, the variable will be used in linear regression analysis.

Morale

Morale (Barnard, 1954:56-61) is the degree to which individuals' motives are gratified. Organizational literature relevant to morale is found in "cohesion," "identification," "solidarity," and "job satisfaction." "Satisfaction" is defined by Price (1968:84) as the degree to which the members of a social system have a positive, affective orientation toward membership in the system, and he considers "satisfaction" as the equivalent term for "morale" in his study of organizations. Following Price's idea the author will use the term "morale" and "satisfaction" interchangably. It is possible to have different levels of satisfaction in the different dimensions, such as satisfaction in work, supervision, co-worker relations, promotion and pay.

Though a causal relationship between morale and goal attainment is very likely, yet, the assertion of the direction of cause and effect is

relatively indecisive since the author feels that their causal relationships can be a reciprocal one. The indecisiveness in asserting causal relationships extends to the causal chains between morale and other variables in the above causal model. For instance, it may be reasonable to consider that high morale leads to high degree of goal attainment or better communication but a high degree of goal attainment or better communication may result in high morale in the organization. Thus, the variable is not specified in a causal framework but will be used in the incomplete specified linear regression model building.

Sanction

Sanction (Klonglan, et al., 1966:17) refers to the rewards or penalties which through their application motivate conformity to the norms of organization regarding both means and goals. The important sanctions applicable to civil defense systems include the rewards such as financial assistance, penalties or restrictions on receiving material resources.

The author considers that most of the effect of receiving or not receiving financial and/or material resources is already determined by the variable of facilities, the variable of sanction is not specified in the above causal model but will be regarded as an additional variable outside of the above causal system. The variable will be used to develop a best linear equation by the method of various regression approaches.

Selectivity

Selectivity, according to Etzioni (1961:154) is the ratio of actual participants over potential ones. By the definition, the degree of

selectivity is a function of potential participants in its organizational environment.

In his empirical study of organizations, Land (1969:6) has employed the variable of selectivity as an exogenous variable since he assumes that the degree of selectivity is predetermined by other forces outside of the establishment of a social system. Schmitz (1971), in a study of local civil defense systems, has hypothesized the existence of cause and effect relationships between selectivity and socialization, selectivity and communication, selectivity and saliency, and selectivity and personal tension. These hypotheses are partially supported by empirical data; the causal linkages between selectivity and socialization, and selectivity and communication are maintained in his model testing.

However, the author questions the use of the variable of selectivity as an exogenous one due to the reason that a local civil defense organization is regarded as an on-going system in the study. To illustrate the author's viewpoint, an organization having better facilities (budget) may attract more potential participants than other organizations, and thus increase the degree of selectivity. Similarly, high degree of organizational complexity (expertise and skills) can be a cause of higher selectivity. Based on the above argument the variable of selectivity is not considered in the above causal model but will be used in the analysis of incomplete specified and unspecified linear regression model building and testing.

Socialization

Socialization (Klonglan, et al., 1966:22) is considered as the process whereby the cultural system's and social system's value orientations are

transmitted to members new and old. According to Merton (1957), socialization involves the acquisition of attitudes and values, of skills and behavior patterns making up social roles established in the social structure. Through the process of socialization members of civil defense systems learn the system's role expectation and the beliefs, goal and means, communication channels, patterns of authority, and so forth.

Schmitz's (1971) study hypothesizes socialization as the direct cause of communication, knowledge-consensus, scope, pervasiveness, and systemic linkage. Most of these hypotheses are supported by the empirical data obtained from civil defense organizations. The exception is the causal relationship between socialization and knowledge-consensus which is not statistically significant. In some of the organization literature empirical studies have shown that socialization and selectivity are two substitutable variables. For instance, Etzioni (1964:70) states that socialization and selection can partially substitute for each other; i.e., the same level of control can be maintained by high selectivity and a low level of organizational socialization as with low selectivity and a high level of organizational socialization. Based on the mutual influence of these two variables and to avoid the use of variables measuring the same underlying factors, the variable of socialization is not specified in the above causal model. However, these two variables will be evaluated and used in the development of the linear regression model.

Ecology

In his study of population and ecology relating to organizational effectiveness, Price (1968:185-202) defined ecology as the degree to which

the membership of a social system is spatially distributed. Other organizational literature relevant to ecology can be found in the discussion of "geographic continuity," and "location," etc. However, empirical studies of the effects of ecology on other organizational variables have been relatively few in the past. In recent years the concept of "ecology" is increasingly emphasized by social scientists. Due to the lack of verified knowledge and theory from past researches about the concept, the author is unable to specify its causal relationship to other variables in the above causal model. However, the author recognizes the popularity and the importance of the concept. The concept will be treated as an additional variable for the development of linear regression model.

CHAPTER IV. METHODOLOGY

This chapter deals with topics related to the procedures of research and research techniques used in the dissertation. The first topic is the operational definition of concepts in which an abstract concept is operationalized in terms of observable or measurable procedures. In addition, discussion of the technique of factor analysis and path analysis, which were used in the analysis of the empirical data in the present study, are the second and third topics respectively.

Operational Definition of Concepts

Goal attainment

An organizational goal is a state of affairs or situation which does not exist at present but is intended to be brought into existence in the future by the activities of an organization. The goal attainment of local civil defense organizations is operationalized as the degree to which official goals are accomplished. The goal attainment was measured in terms of seven official task areas stated in a management document which is called the program paper. These seven task areas include: (1) licensing, marking and stocking of eligible buildings, (2) direction and control consist of two subtasks: "establishing an emergency operating center" and "arranging for the use of emergency radio communication systems," (3) establishing a basic operational survival plan, (4) training and public education (5) public information activities, (6) emergency services 1 (warning services and radiological defense services), (7) emergency services 2 (assigning other emergency services to other individuals and agencies in the community). The

degree of achievement in each task area is indicated by a score range from 0 to 100.

The degree of goal attainment in each local civil defense organization was measured by the linear combination of these seven task areas. The relative weight of each task was determined by the method of pair comparisons using federal civil defense personnel as "judges." These weights vary from seven points for the most important task (license) to one point for the most unimportant task (emergency service 2). The maximum possible score for the variable is 2,800; the minimum possible score is zero. The range of the calculated socres was from 51 to 2400. The mean of the "goal attainment" score was 1514.52 with a standard deviation of 507.52.

Interorganizational relations

Interorganizational relations is defined as the interdependence among complex organizations on the basis of resource need. The concept was operationalized as the extent to which a local civil defense organization has worked with other formal organizations.

A series of composite scores was obtained to measure the various degrees of the variable. To determine the weight system in formulating the composite score, the director of each civil defense organization was asked to name and rank the three most influential organizations from a list of 23 organizations within the civil defense area. The name of these organizations were attached in Appendix A. Following this ranking the director was asked to indicate those formal organizations that his organization had worked with in some type of civil defense activity from the list of 23 organizations (the director could add any other influential formal organization if it was not on the list). Based on their answers, the points were

assigned according to the following standard:

Points	
0	Most influential organization (Ranked 1) but had not worked with it.
1	Second most influential organization (Ranked 2) but had not worked with it.
2	Third most influential organization (Ranked 3) but had not worked with it.
3	Influential organization but not ranked as one of top three, but had not worked with organization in civil defense area.
4	Not an influential organization and had not worked with it; or no such organization in civil defense area.
5	Not an influential organization but had worked with it.
6	An influential organization but not ranked as one of top three, and had worked with it.
7	Third most influential organization (Ranked 3) and had worked with it.
8	Second most influential organization (Ranked 2) and had worked with it.
9	First most influential organization (Ranked 1) and had worked with it.

The total score for each local civil defense organization was computed by adding together the points obtained on each of the formal organizations named by the directors. The theoretical distribution of the total scores is 0 - 207. The obtained scores ranged from 77 to 137. The mean for the "interorganizational relation" score was 106.92 and the standard deviation was 11.

Intraorganizational coordination

Intraorganizational coordination was defined in the last chapter as the orderly arrangement of group effort to provide unity of action in the

pursuit of a common purpose. This concept is operationalized in this chapter as the extent to which a local civil defense organization has worked with local groups and individuals within its civil defense area and the degree of productivity in these works. The variable was measured in two parts: the first part was the degree of work productivity with groups and organization; the second part was the strength of work relations for future cooperation. To determine the score for the first part each director was asked to indicate those groups among a list of 20 groups (each director could add other groups to the list) that his organization had worked with during the past year. The name of these groups or individuals was included in Appendix B. The directors were then asked to indicate the productivity of these working relationships in terms of civil defense...very productive, somewhat productive or unproductive. A local civil defense organization received three points for each group or individual representing a particular group that it had worked with and established a "very productive" relationship, two points for each group or individual representing a particular group that it had worked with and established a "somewhat productive" relationship and one point for each group or individual if the working relationships with each group or individual was unproductive. A local civil defense organization which had not established working relations with these groups or individuals received no points.

To determine scores for the second part, the directors were then asked to indicate the estimated ties for future cooperation for each of the above 20 groups that his office had worked with in the past year. The points assigned to each local civil defense organization were as follows: three

points for each group or individual representing a particular group if a strong tie for future cooperation had been established; two points for each group or individual representing a group if a weak tie existed for future cooperation, and one point for each group or individual if no ties for future cooperation existed. Moreover, if there exists no such groups or no individuals representing such groups, no points were given to the local civil defense organization.

The possible distribution for part one and part two both range from 0 to 69. The calculated scores for part one were from 0 to 60 and were from 0 to 63 for part two. The total score for this variable was obtained by summing together the two total points received in part one and in part two. The total possible score for the variable could range from 0 to 138, but the calculated scores vary from 0 to 120. The mean for the "intraorganizational coordination" score was 58.26, and the standard deviation was 28.15.

Institutionalization

Institutionalization is the degree to which the decisions of a social system are supported by its environment, and the environment refers to anything external to the organization. The author proposed that institutionalization could be indicated by the extent to which the local civil defense organizations are accepted by local individuals, groups, and organizations, and the degree to which the local civil defense organizations are established as "going concerns." Since institutionalization has to do with the establishment of the system, the concept is operationalized as the system building activities of the civil defense organization. The variable of system building was composed of three parts: part I is related to the

program paper since the presence of this paper implies that the local civil defense organization had at least partially legitimized and sanctioned the local civil defense program. Part II and part III cover organization establishment and operational activities respectively.

To obtain information for part I each director of local civil defense organizations was asked three questions: (1) "does your civil defense area have a program paper? (2) is your civil defense area participating in government personnel and administration (P & A) funds? (3) is your civil defense area participating in government hardware matching funds?

Points assigned to each organization based on the answers to part I are shown below:

Possible points	Answer
6	Local area has a program paper, and has received both P & A funds and Hardware Funds.
5	Local area has a Program Paper and has received P & A funds.
4	Local area has a Program Paper and has received Hardware Funds.
3	Local area has a Program Paper, but has received no P & A funds or Hardware Funds.
0	No Program Paper.

The possible distribution of this score ranged from 0 to 6.

Part II was designed to measure the degree of organizational establishment increased during a year. This was obtained by comparing the current facilities of the organization (number of full-time, paid personnel, office space, budget, etc.) with the previous year. Points were assigned to the organization according to the following:

	Possible Points
1. Budget change:	
a. No funds either year	0
b. Less funds this year	1
c. Same funds as last year	1
d. More funds this year	2
2. Personnel change:	
a. No paid personnel either year	0
b. Less paid personnel this year	1
c. Same number of personnel this year	1
d. More personnel this year	2
3. Change in office space:	
a. No space either year	0
b. Less space this year	1
c. Same office space this year	1
d. More office space this year	2

The possible points that a local civil defense organization could receive on part II range from 0 to 6.

Part III consists of the question of whether or not a local civil defense organization had a separate office and a separate annual budget, since the existence of a separate office and separate annual budget could be regarded as evidence of the relative establishment of the organizations. The points for this part are determined as follows:

Possible Scores	Response
	question 1: separate office:
3	(a) yes
0	(b) no
	question 2: separate budget
3	(a) yes
0	(b) no

The theoretical scores for part III range from 0 to 6 by summing the points in the above two answers.

The composite scores measuring the variable of institutionalization were obtained by adding together the points received on part I, II, and III. The theoretical distribution of the composite scores could range from 0 to 18; the calculated scores also varied from 0 to 18. The mean of the composite score for institutionalization is 8.23 with a standard deviation of 5.24.

Communication

Communication is the process by which information, decisions, and directives are transmitted among actors and the ways in which knowledge, opinions, and attitudes are formed or modified by interaction. The empirical index of the concept was operationalized and indicated by frequency and type of communication that the director of local civil defense organization made with nearby local civil defense personnel. The index consists of two parts.

Part I measured the most typical means of communication with nearby civil defense personnel. The points assigned to part I were based upon both how personal the communication was and how typical a given means of communication was between the directors and other civil defense people in nearby towns and counties. A weight of five points was given to the most personal communication and one point to least personal communication. Also a weighting system of 0 to 5 was used to assign points according to how typical the communication was. Since the weighting system depends on two criteria, the points were determined from the following "personal" and "typical" communication matrix:

Table 4.1. "Personal" and "typical" communication matrix

Type of Communication	"Personal" Weight	How "Typical" and Weight					
		Never used 0	5th 1	4th 2	3rd 3	2nd 4	1st 5
1. Two-way oral in a face-to-face situation	5	0	5	10	15	20	25
2. By telephone	4	0	4	8	12	16	20
3. By tape recording, public address system, motion pictures, etc.	3	0	3	6	9	12	15
4. By letter	2	0	2	4	6	8	10
5. By one-way written memo, brochure, etc.	1	0	1	2	3	4	5

The total points of part 1 for each local civil defense organization were obtained by summing together the points in the cells that were determined according to the answer of local directors to the above two questions. For example, the maximum points for a local civil defense organization is 55 by summing together the points on the diagonal cells of 25, 16, nine, four and one; the minimum points is 0 since the sum of all five zero cells equals to zero. The range of the calculated points for part 1 ranged from 0 to 54 points.

Part 2 of the communication variable is concerned with the frequency with which the director of the organization engaged in the types of

communication listed on the questionnaire with civil defense staff in nearby towns and counties. For each type of communication, the directors were asked to indicate how often (never, seldom or often) they engaged in these types of communication with civil defense people in nearby towns and counties. The weight system of one to five was assigned according to how "personal" the communications were, and the weight of 0, 3 and 6 were assigned to never, seldom and often use communication. Thus a "how personal" and "how frequently" communication matrix is established as follows:

Table 4.2. Frequency and the types of communication

Type of Communication	"Personal" Weight	How "Frequently" and Weight		
		Never	Seldom	Often
		0	3	6
1. Two-way oral in a face-to-face situation	5	0	15	30
2. By telephone	4	0	12	24
3. By tape recording, public address system, motion pictures, etc.	3	0	9	18
4. By letter	2	0	6	12
5. By one-way written memo, brochure, etc.	1	0	3	6

The theoretical distribution of the scores in part 2 range from 0 to 90 since the sum of minimum scores of five cells in the above matrix is 0

and the sum of maximum scores of five cells in the matrix is 90. The observed distribution of the score was 0 to 90.

A local civil defense organization's total score for the empirical measures of communication was obtained by adding together the above two sub-scores of part 1 and part 2, thus the theoretical distributuion of the total score is from 0 to 145. The calculated scores for the communication variable ranged from 0 to 142 with a mean of 93.16 and a standard deviation of 27.38.

Complexity

Organizational complexity is defined as the level of knowledge and expertise in an organization. Following Price's suggestion that the degree of complexity of an organization can be measured by the degree of education of its members, the concept was operationalized in the dissertation as the amount of formal civil defense training that each director had. In a strict sense, the average civil defense training of all of the organizations' members should be a better index for the variable. However, the use of directors' training as the empirical measures of the complexity and communication varible is justified by the fact that 92.5 percent of the 240 local civil defense organization had less than 1.5 paid men in the fiscal year. Thus, it is reasonable to employ the directors' civil defense training as an empirical index for each organization.

The score for the empirical index of organizational complexity was measured by the total number of days of formal training that a director of local civil defense organization had. The "complexity" scores ranged from 0 to 189 with a mean of 12.15 and a standard deviation of 24.64.

Representation

Representation is the practice of a social system's members joining other social systems with the goal of increasing its institutionalization. The concept was measured empirically by the total number of formal organization membership with which the director of a civil defense organization associated. A civil defense organization received one point for each director's current membership in a formal organization and one point for each director's past membership. The distribution of the calculated representation scores ranged from 0 to 22 with a mean of 7.69; and a standard deviation of 4.02.

Size

Size refers to the number of human agents of the social system. The empirical indicator of the concept was operationalized and measured by the population of the local civil defense area. The civil defense areas investigated by the studies ranged in population from approximately 100 people to 850,000 people. The mean of the variable on size was 18,490.42 with a standard deviation of 61,422.80. This is due to the wide spread of score distribution.

Facility

A facility is a means used to attain ends (goals) within the social system. Since the unit of analysis in the study is each civil defense organization, not an individual, and it is logical to think that money (budget) is the means or resource to buy equipment for organization activities, to carry out programs or to pay expenses of organizational activities in order to achieve civil defense goals. Thus, the concept was operationalized

and measured by the budget for a local civil defense area. The measures for the variable were determined empirically by the actual amount of funds received by each local civil defense organization from one of a combination of public budgets from city, county and/or federal government appropriation but excluding privately contributed funds.

The score of the measures was the actual civil defense budget in dollars. The budgets of the 240 local civil defense organization investigated in the study ranged from nothing to $160,176; this yeilds the mean of the scores was 3502.52 with a standard deviation of 11478.02.

Norms

Norms are the social system's rules which prescribe what is acceptable and unacceptable behavior. In the system of civil defense organizations, written rules are one type of norms which are important for local civil defense units. In general, these rules were established by the federal civil defense organization for local organizations. The rules are important to local civil defense units in the sense that the more a local civil defense organization can obtain facilities such as financial assistance from federal organizations, the more resources can be used to achieve organizational goals. The understanding of rules for federal assistance is used as the empirical measurement of norms. Recall that the amount of budget of a local civil defense organization was used as the index of organization facilities. The score on the variable for each organization was determined by summing together the points obtained in each directors' answer of six items, which included three correct rules and three deliberately constructed incorrect rules. The characteristics of the distribution of the socres for norms are: (1) the theoretical distribution is from 0 to 96; (2) the range

for the computed scores was from 39 to 96; (3) the mean was 75.32; and (4) the standard deviation was 15.42. The detailed description of the scores is attached in the Appendix C.

Morale

Morale refers to the degree to which individuals' motives are gratified. Since motives are those impulses that stimulate an individual to act in a specific manner, the interesting aspects of a local director's job was employed as the empirical index of the concept. The variable consists of the following five parts: part 1 measures the director's perception of the opportunity that his position gives him to do the things from which he gets the most satisfaction, part 2 measures the director's perception of the importance of having the opportunity to do things from which he gets most satisfaction, part 3 concerns the disliked aspects of the director's job that he perceived, part 4 measures the importance of not having to do things that he dislikes as a civil defense director, and finally, part 5 is concerned with the director's perception of whether he would take his current civil defense position if he had the decision to make again.

The total score for the empirical index was determined by the sum of the scores that a director received for each of the above five parts. The theoretical score could range from 0 to 80. The observed distribution for "morale" scores had a mean of 51.03 and a standard deviation of 13.13.

Sanctions

Sanctions are rewards or penalties which through their application motivate conformity to the norms regarding both means and goals. Since one of the important rewards or penalties that a local civil defense organization may receive is financial assistance, and one of the standards for a

local unit to receive financial aid is the establishment of a basic Operational Survival plan for each local civil defense area, the concept was operationalized and measured by the directors' perceptions of the possible rewards and/or penalties related to the advantages of establishment of the plan.

The score for the empirical measures consists of two parts: part 1 was composed of seven items measuring the benefit of having a state-approved civil defense plan, part 2 was composed of eight items measuring the reasons for setting up the plan. The total score for each local unit was obtained by combining the points that a director of the local organization received on part 1 and part 2. The possible score of the index ranged from 0 to 24. The observed distribution of sanctions scores is as follows: the mean was 11.36 and the standard deviation was 6.24. For more detailed description of the scores see Appendix D.

Selectivity

Selectivity of an organization is defined as the ratio of actual participants over potential ones. The concept was operationalized and measured as the degree of selectivity of a director in each local civil defense organization. In order to determine a score to indicate the variability of the empirical measurement, each director was asked two questions; one concerning the number of people other than the director himself who were interested in competing for the director's position and the second question related to his perceptions about the degree of selectivity used by others when he was chosen for the position. The total score for the variable was obtained by summing together the two sub-scores. The theoretical and

observed distribution of values for the index of selectivity was from 0 to 7. The mean was 3.21 and the standard deviation was 1.25. The detailed description of the score is attached in Appendix E.

Socialization

Socialization in the present study is defined as the process whereby the cultural system's and social system's value orientations are transmitted to members new and old. From the point of view of local civil defense organization, this concept has to do with the mechanisms by which members of the system become familiar with the system's role expectations and demands, patterns of authority, goal, and so forth. Again, the director of the local organization was regarded as the representative unit of analysis for the organization. Thus, it is assumed that the more job orientation a director received from the civil defense organization, the higher the degree of socialization the organization has.

The empirical index of the variable was composed of five questions designed to measure the amount and quality of job orientation a director of a local civil defense organization had received after accepting the position: (1) from local government officials, (2) from other local directors, (3) from state civil defense personnel, (4) about how well he understood his responsibilities and commitments; and (5) about how much additional education or training needed for a successful job performance. The total score for the variable was obtained by adding together the points he received from the above five questions. The possible scores for the variable range from 0 to 36; the calculated scores ranged from 9 to 36; the mean was 23.00; and the standard deviation was 5.14. For more detailed description of the scores see Appendix F.

Ecology

Ecology is defined as the degree to which the membership of a social system is spatially distributed. The concept was operationalized and measured by the amount of local civil defense office space of each local unit. The actual number of square feet of office space of each local unit was the score as the empirical measures of the variable.

The theoretical score of the variable was from zero up; and the observed distribution range from 0 to 9,000; due to the wide spread distribution the mean was 448.40 with a standard deviation of 1049.53.

In the closing page of the operational definition of concepts, the author would like to make a note about the rationale behind some of these operationalizations. Among the fifteen concepts operationalized, the four concepts of "communication," "complexity," "representation," and "morale" were measured empirically, based on a director of a local civil defense as the representing unit for his organization. The reasons for doing so are found in the following arguments. Since only the director of a local civil defense organization was interviewed during the field work, and a director was in the position to make decisions for the organization, the director should be regarded as a best representing unit for his organization than other personnel. Another fact that strongly supported the use of directors as the representing unit for these organizations was that 92.5 percent of these 240 local civil defense organizations in the present study had an average of paid personnel less than 1.5 persons, including the director himself. The observed distributuion of the number of paid civil defense personnel is shown in the following table:

Table 4.3. Number of paid civil defense personnel

Interval (paid man)	Minnesota		Georgia		Massachusetts		Total	
	No.	%	No.	%	No.	%	No.	%
zero	58	76.3	33	41.3	66	78.6	157	65.4
Less than 1.0	10	13.2	9	11.3	9	10.7	28	11.7
1.0 - 1.5	7	9.2	25	31.3	5	6.0	37	15.4
1.6 - 2.0	--	--	11	13.8	3	3.6	14	5.8
2.1 - 2.5	--	--	1	1.3	--	--	1	.4
3.6 - 4.0	--	--	1	1.3	--	--	1	.4
4.6 -5.0	--	--	--	--	1	1.2	1	.4
16.0	1	1.3	--	--	1	--	1	.4
Total	76		80		84		240	

On the basis of these reasons, the author believes it was logical and reasonable to use these empirical measures as indices for these local civil defense organizations.

Factor Analysis

In the present section the author will briefly review the technique of factor analysis, including what it is, what is the procedure in extracting factors, model and assumptions, and how to solve them.

In measuring a relatively abstract psychological or sociological concept, an empirical investigator often constructs a large number of items or empirical variables to indicate the various dimensions or aspects of the concept. It is possible that these items or empirical variables overlap with each other or several items may measure the same dimension of the concept since the construction of these items are frequently based on the

investigator's prior orientation or conceptualization about the concept. If the correlations between items or variables turn out very high, say, correlation coefficients are higher than .70, then it means that what these highly correlated items measured is half-overlapped since the square of the correlation coefficients indicates the overlapping portion between any pair of these variables. In the above cases an investigator can utilize the technique of factor analysis on the data to extract a general variable as the empirical index of the concept instead of using those original items. Thus, the most distinctive characteristic of factor analysis is to test or to extract some underlying factors (general variables) from the orignially constructed items. Since these underlying factors (general variables) in most cases are the linear combination of several original similar items (empirical variables), factor analysis not only can reduce original data to a smaller form but also provide better interpretation and useful measures in terms of composites and indices.

Possible uses of factor analysis are many and vary with research situations. Kim (1970) classified the most common applications of factor analysis as (1) exploratory use--the exploration and detection of patterning of original variables in the hope of discovering new concepts and a possible reduction of data; (2) confirmatory use--to test hypotheses about the nature and pattern of variables in terms of the expected number of factors and factor loadings; and (3) use as a measuring device--the construction of indices to be used in later analysis.

In the following few pages the author would like to review the general procedures in performing factor analysis and solutions based on two models.

The first step in performing factor analysis is the preparation of a correlation matrix based on original variables (items) or units (people); usually, product-moment correlations between all possible pairs of variables in the original data are most commonly used in the step. The second step is to extract initial factors or general variables from the correlation matrix.

Two different linear models for two distinctive objectives of the extraction are:

(1) Principal Component Linear Model: to extract the maximum variance. The model can be written in the following mathematical formula

$$Z_i = a_{j1}F_1 + a_{j2}F_2 + \ldots\ldots\ldots\ldots a_{jn}F_n$$

Where J = 1, 2 .....m

F_i's are uncorrelated components

(2) Classical Factor Analysis Linear Model: to best reproduce the observed correlations, the model is

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + \ldots\ldots\ldots\ldots a_{jm}F_m + d_jU_j$$

Where J = 1, 2 .....n

Z_j = variable j in standardized form

F_i = hypothetical factors

U_j = unique factor for variable j

a_{ji} = standardized multiple-regression coefficient of variable j on factor i (factor loading)

d_j = standardized regression coefficient of variable j on unique factor j.

This model assumes the unique factor u_j is orthogonal to ail the common factors and to other unique factors associated with other variables, that is,

$$Cov(F_i, u_j) = 0 \qquad \text{for } i = 1, 2.....n,\ j = 1, 2.....n$$

$$Cov(u_j, u_k) = 0 \qquad \text{for } j \neq k$$

This means that the unique portion of a variable is uncorrelated with any other variables or that part of itself which is accounted for by the common factor.

There are direct and stepwise solutions to the above two models based on two different frameworks. If a researcher has enough theory or knowledge about the nature and pattern of empirical variables such that specifications about the exact number of factors and the nature of linear combinations are possible, then the direct solution should be employed. It is mainly for confirmatory use--to test an hypothesis about the existence of factors. More specifically, in doing the direct solution a researcher must specify in advance the exact number of factors to be extracted and weights for the linear combinations based on theoretical knowledge or past similar researches. The results of the solution provide evidence to support or reject the hypothesis. Spearman's general-factor solution, Holzinger's bifactor solution, and the multiple-group centroid method are some examples of the direct solution. The multiple-group centroid method can be applied to test one or more hypothesized factors (general variables). Since the author wants to test the hypothesis about the existence of a general variable which is a best index for the goal attainment of civil defense organization, and the weights for the linear combination is specified to be unity, the direct solution was employed first in the present study. A note should be made that even though the above two linear models are applicable for the direct

solution, the classical factor analysis linear model is the one utilized in the present direct solution.

On the other hand, the stepwise solution is divided into the following two steps:

(1) Condensation: This step is to condense the variables into a relatively small number of common factors. The condensation procedure can be achieved by group centroid method involving reflection, square-root method, and principal axes methods.

(2) Rotation of factor: The initial factors derived from the first step are rotated to obtain a more interpretable pattern of factor loadings and to facilitate estimations of the scores of people on the factors. A rotated factor is simply a linear combination of the original factors. Though the rotated factors explain no more of the origianl variance than unrotated factors, they do rearrange the variance to a more interpretabel pattern. An ideal rotation is to achieve a simple structure in which each variable loads on one and only one factor, and there are orthogonal and oblique rotations. The varimax method developed by Kaiser is a commonly used procedure to obtain orthogonal rotation, and Quartimin is one of the methods used to perform oblique rotations.

It should be noted that, while direct solutions rely on theoretical knowledge in specifying the number and weights of the linear combination, no prior assumptions about the nature of linear combination are needed in performing stepwise solutions. The resultant factors in the stepwise solution are mainly derived by mathematical reasoning. Since the assumptions underlying direct and stepwise solutions are different, it is worth-while to compare and contrast the results of the two solutions based on same data.

So, in carrying out a stepwise solution in the present study, the author applied the principle axes method, which is based on the principle component linear model, to condense the variables and the varimax approach to perform the rotation procedures.

In sum, although either direct or stepwise solution may be sufficient for testing the homogenity of items, both direct and stepwise solutions to the factor analysis of the dependent variable (goal attainment) in the present study were carried out. The purpose for doing so is mainly to compare and contrast the results. In the present direct solution the multiple-group centroid procedure based on the classical factor model was used to confirm the hypothesis about the existence of a general variable. In the stepwise solution, the principle axes method based on the principle component model was employed to condense variables and Kaiser's varimax approach was used in the rotation procedure. More detailed discussion and empirical results about the performance of factor analysis are presented in Chapter V.

Path Analysis

Path analysis has proved extremely effective in practical applications in the study of genetic systems as well as in the empirical analysis of assymetrical cause-and-effect relationships in a set of correlated variables. The technique was originated by Professor Sewall Wright, and its content was exposed in a series of articles, under the authorship of Professor Wright, dating from the early 1920's. It was nearly 40 years after these publications that social scientists began to apply path analysis in model testing and theory construction. It started with Simon and Blalock's discussion of causal model inference in the late 1950's and early 1960's. Then, Boudon

pointed out in his 1965 article that the Simon and Blalock model testing is a weak form or special case of path analysis. Following Boudon's article, Duncan published a comprehensive, well organized article about the sociological examples of path analysis in 1966. Since then social researchers are well aware of the existence of and wide-range application of path analysis.

In the following discussion the author will try to present briefly some properties of path coefficients, and basic theorems of path analysis that are applicable to empirical investigation of sociological or social phenomena.

Path coefficients and path model

In the present section the author will not consider those philosophical problems of what is the notion of causality and why it has been. Instead, the author will assume the existence of prior or empirical grounds for postulating the statement that variation in some variables is produced by other variables or that certain pairs of variables are related as the results of certain common cause(s). In order to describe these kinds of cause and effect relationships among variables, the author uses the arrow ($\longrightarrow$) to indicate the directional influence (symmetrical) or force and a double-arrow curve ($\curvearrowleft\!\!\curvearrowright$) to indicate symmetrical correlation.

Path coefficient The path coefficient P_{yx_i} for the path from the variable x_i (cause) to the dependent variable y is a number that "...measures the fraction of standard deviation of the endogenous variable (with the appropriate sign) for which the designated variable is directly responsible in the sense of the fraction which would be found if this factor varies to the same extent as the observed data while all other variables

(including residual variable) are constant" (Wright, 1934:162; Land, 1969:9). It can be defined mathematically as:

$$(1a) \qquad P(y \leftarrow x_i) = P_{yx_i} = \frac{\sigma x_i : y}{\sigma y} = \frac{S x_i : y}{S y}$$

or

$$(1b) \qquad P_{yx_i} = \frac{\sigma y.12 \text{ --- } (x-1)(x+1) \text{ --- } na}{\sigma y} \times \frac{\sigma x_i}{\sigma x_i.12 \text{ --- } (y-1)(y+1) \text{ --- } na}$$

Where Y is the independent effect and is assumed as the linear combination of x_1, x_2, x_3 ---------

X_i's are the causes in the causal system

S_y is the total standard deviation of Y

$S_{x_i:y}$ is the part of total standard deviation of Y due to full influence of the cause x_i when all the other causes are kept constant.

The symbol P denotes the path, the arrow shows the direction of path, and the subscripts are used in accordance with the convention for regression analysis. The first subscript defines the effect or dependent variable, the second subscript identifies the cause or independent variable whose direct influence on the dependent variables is indicated by the path coefficients. In equation (1b), if variable x_i is statistically independent of all other variables in the system, then the equation reduces to

$$P_{yx_i} = \frac{\sigma y.12 \text{ --- } (x-1)(x+1) \text{ --- } na}{\sigma y} \quad \text{since} \quad \frac{\sigma x_i}{\sigma s_i.12 \text{ --- } (y-1)(y+1) \text{ --- } na}$$

is a unity.

The above definition of path coefficient implies a very important assumption that can be best described in the following paragraph by Li (1955: 149):

> ...it is assumed (in a path coefficient) that the direct influence along a given path can be measured by the standard deviation remaining in X after all other paths of influence are eliminated, while the variation of the cause back of the given path (X's variation) is kept as great as ever regardless of its relations to the other causes which have been made constant.

It is rather questionable whether the force of the particular cause X_i can keep as great as before in a system of correlated variables, it seems that the assumption is quite weak on empirical grounds.

Some properties of path coefficient

(i) It can be shown that path coefficients are equivalent to partial regression coefficients (b's) if the variables are measured in standardized form. As a matter of fact, the value of path coefficient can be obtained by utilizing the formula: $b^*_{yx_i} = b_{yx_i} \frac{S_{x_i}}{S_y}$.

(ii) The path coefficient P_{yx_i} is an absolute value without any physical unit. In this respect it is very similar to correlation coefficient r.

(iii) The path coefficient P_{yx_i} has a direction. This is very similar to regression coefficient; a regression coefficient is also directional but with physical unit attached, e.g., lb/inch.

(iv) Because of the directional property it is known that $P_{yx_i} \neq p_{x_iy}$ while the correlation coefficients of r_{yx_i} is equal to r_{x_iy}.

(v) As mentioned above, path coefficient P_{yx_i} is an absolute value while regression coefficient b_{yx_i} has physical units attached,

such as grams/inch. These two coefficients are equivalent in their value but differ with each other in terms of physical unit.

(vi) A path coefficient may take positive value as well as negative value. For example, in a system of two related independent variables, if the variance of a cause is greater than the variance of an effect, then the other path coefficient must take a negative value.

(vii) Path coefficient may have a value greater than unity since there are no restrictions on the relative magnitudes of the variance of a cause and an effect. When the variance of a cause is greater than that of an effect, the path coefficient will be greater than one.

(viii) It is possible that variable X and variable Y are not correlated (i.e., $r_{xy} = 0$) but the path coefficient from X to Y is not zero when other variables are considered. This shows another difference between a correlation coefficient and a path coefficient. The correlation coefficient measures the correlation between two variables in a given set considering only these two variables while path coefficient indicates the directional influence of one variable on another in a set of related variables.

(ix) As mentioned above: $P_{yx_i} \neq P_{x_iy}$, because path coefficient has direction. Thus if the direction of a path were changed, then, its value will also change; in addition, the value and directions of other paths in the system of related variables should be changed accordingly.

Types of path models The formulation of a causal scheme is a very important step in doing path analysis. Only an adequate and complete causal scheme will result in a valid path coefficient. In this section the author shall consider some simple causal schemes involving less than four variables and use them to demonstrate how path coefficient can be applied.

(i) Simple direct cause model:

The simplest causal scheme $X \longrightarrow Y$ indicates that X is a direct cause of Y. In this case there exists only one path connecting X and Y, whose coefficient is denoted by P_{yx}. By definition we have:

$$\because b = r\frac{Sy}{Sx}, \quad r = b\frac{Sx}{Sy} = P_{yx} \text{ ----------(2)}$$

(ii) Independent causes model:

Suppose two variables, denoted by X_1 and X_2 respectively, are uncorrelated and both of these two variables are the cause of the dependent variable Y as shown in the following causal scheme:

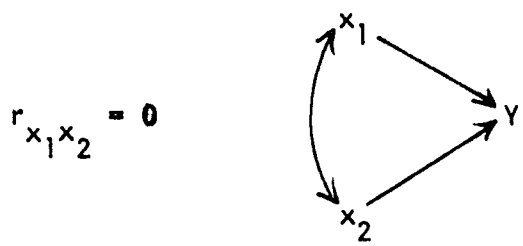


Figure 4.1. Path model of uncorrelated causes

Assume it is a linear model such that $Y = X_1 + X_2$, then it can be shown that

$$S_y^2 = S_{x_1}^2 + S_{x_2}^2 + 2S_{x_1x_2}$$

$$= S_{x_1}^2 + S_{x_2}^2 + 2r_{x_1x_2}S_{x_1x_2} \qquad (r_{x_1x_2} = 0)$$

$$= S_{x_1}^2 + S_{x_2}^2 \text{ ----------(3)}$$

In the present case, there are two paths in the system; one path connecting X_1 and Y, the other connecting X_2 and Y. These two paths can be viewed separately as two simple direct causes since the two are independent from each other. Thus,

$$P_{yx_1} = \frac{S_{x_1:y}}{S_y} = \frac{S_{x_1}}{S_y} \qquad (\because S_{x_1:y}^2 = S_{x_1}^2) \text{ ----------(4a)}$$

$$P_{yx_2} = \frac{S_{x_2:y}}{S_y} = \frac{S_{x_2}}{S_y} \qquad (\because S_{x_2:y}^2 = S_{x_2}^2) \text{ ----------(4b)}$$

(iii) Chains of independent causes model:

Suppose there are two sets of independent causes in the causal scheme diagrammed as below:

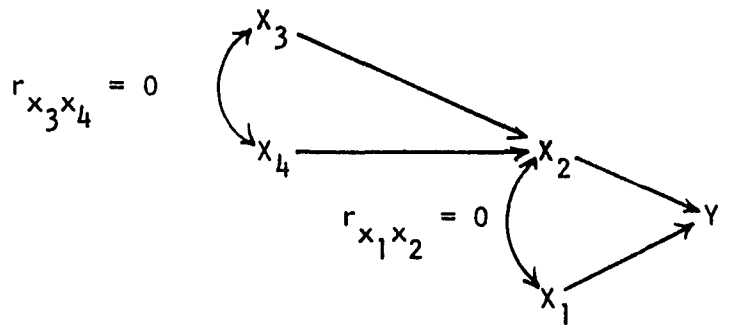


Figure 4.2. Path model of chains of independent causes

Let us assume again the causal relationships in the system of related variables are linear and additive, that is,

$$X_2 = X_3 + X_4$$

$$Y = X_1 + X_2 = X_1 + X_3 + X_4$$

where $r_{x_3x_4} = 0$, $r_{x_1x_2} = 0$. Then by similar reasoning in the preceding

discussion, we have

$$S_y^2 = S_{x_1}^2 + S_{x_2}^2 = S_{x_1}^2 + S_{x_3}^2 + S_{x_4}^2 \text{ ----------(5)}$$

and it follows immediately that:

$$P_{yx_2} = \frac{S_{x_2:y}}{Sy} = \frac{S_{x_2}}{Sy}$$

$$P_{x_2x_4} = \frac{S_{x_4:x_2}}{S_{x_2}} = \frac{S_{x_4}}{S_{x_2}}$$

$$P_{yx_4} = \frac{S_{x_4y}}{S_y} = \frac{S_{x_4}}{S_y}$$

Thus the following important theorem of path coefficients can be achieved by observing the above equations:

$$P_{yx_4} = \frac{S_{x_4}}{S_y} = \left(\frac{S_{x_2}}{S_y}\right)\left(\frac{S_{x_4}}{S_{x_2}}\right) = P_{yx_2} P_{x_2x_4} \text{ ----------(6)}$$

$$r_{yx_4} = r_{yx_2} r_{x_2x_4} \text{ ----------(7)}$$

Equations (6) and (7) give us the important principle in the path analysis: the path coefficient, and the correlation coefficient between an independent cause and its effect are equal to the product of the corresponding individual coefficients along the chain connecting the cause and the effect. The above correlation equation $r_{yx_4} = r_{yx_2} r_{x_2x_4}$ shows the identical conclusion discussed in the last chapter of the Simon-Blalock model inference; that is, we expect the largest correlation among the set of related variables to occur between two adjacent variables, and the smallest correlation takes place between variables furthest away from each other.

(iv) Common cause model:

Let Y_1 and Y_2 be two effects and both are influenced by the common cause X, thus, the system of related variables is represented by the following causal scheme:

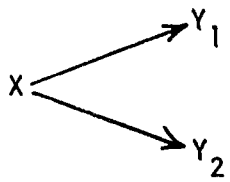


Figure 4.3. Path model with one common cause

In this case, we have:

$$P_{y_1x} = \frac{S_{x:y_1}}{S_{y_1}} = \frac{S_x}{S_{y_1}} = r_{y_1x} \quad , \qquad P_{y_2x} = \frac{S_{x:y_2}}{S_{y_2}} = \frac{S_x}{S_{y_2}} = r_{y_2x}$$

Two important characteristics of this model can be obtained: 1) the path coefficients $P_{y_1y_2} = 0$ and $P_{y_2y_1} = 0$ since no path connects variable Y_1 and Y_2; 2) if the influence of the common cause X is eliminated then the partial correlation $r_{y_1y_2 \cdot x} = 0$, thus

$$0 = r_{y_1y_2 \cdot x} = \frac{r_{y_1y_2} - r_{y_1x}r_{y_2x}}{\sqrt{1 - r_{y_1x}^2}\sqrt{1 - r_{y_2x}^2}}$$

$$\therefore \quad r_{y_1y_2} = r_{y_1x}r_{y_2x} = P_{y_1x}P_{y_2x} \neq 0 \text{ ----------(8)}$$

The no-zero value of correlation coefficient between Y_1 and Y_2 is due to the common cause of X.

(v) Models of correlated causes:

In the preceding discussion we have been concerned with models of uncorrelated causes. Now we pass on to take a look at models in which the independent variables (causes) are correlated with themselves. We will start with a simpler model having only one dependent variable (effect). To be consistent with our previous notations, let y denote the dependent variable (effect) and x denote the independent variables in the following discussion. Now, let us suppose a causal scheme represented as in the following diagram:

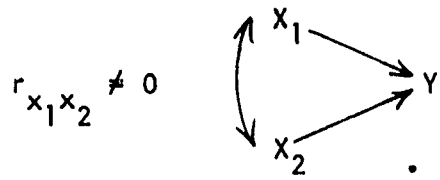


Figure 4.4. Path model of correlated causes and single effect

Since only those linear and additive relationships among variables are concerned in the present discussion, the equation is $Y = P_{yx_1}X_1 + P_{yx_2}X_2$ as before but this time variable X_1 and X_2 are correlated. If all variables in the system are measured in standardized form, then:

$$r_{yx_1} = \frac{1}{n}\Sigma X_1 Y$$

$$= \frac{1}{n}\Sigma X_1 \left(P_{yx_1}X_1 + P_{yx_2}X_2\right)$$

$$= P_{yx_1}\frac{1}{n}\Sigma X_1X_1 + P_{yx_2}\frac{1}{n}\Sigma X_1X_2 = P_{yx_1} + P_{yx_2}r_{x_1x_2}$$

This result can be generalized to more complex systems with n variables, the formula can be summarized as:

$$r_{ij} = \sum_q P_{iq} r_{qj} = \sum_q P_{iq} r_{jq} \text{ ----------(10)}$$

Where the index q runs over all variables from which paths lead directly to X_i, i and j are two variables in the system.

The basic theorems of path analysis

Recursive system of equations To begin the present discussion, the author will consider a set of five causally related variables: X_1, X_2, X_3, X_4 and X_5. The first four will be considered as independent variables and the last one (X_5) is the dependent variable in the model. Suppose theory or verified knowledge from the substantive discipline enables the establishment of the cause and effect relationships among these five variables as indicated in the following causal model:

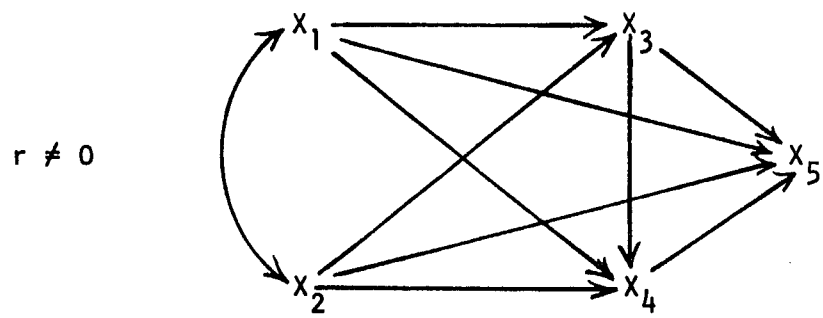


Figure 4.5. Full recursive causal model with all paths

Based on the above scheme a set of equations can be written, which are a recursive system, to represent these cause and effect relationships among the variables, that is:

$$X_1 = E_1 \text{ ----------(B-1)}$$

(1) $$X_2 = E_2 \text{ ----------(B-2)}$$

$$X_3 = b_{32}X_2 + b_{31}X_1 + b_{33}E_3 \text{ ----------(B-3)}$$

$$X_4 = b_{43}X_3 + b_{42}X_2 + b_{41}X_1 + b_{44}E_4 \text{ ----------(B-4)}$$

$$X_5 = b_{54}X_4 + b_{53}X_3 + b_{52}X_2 + b_{51}X_1 + b_{55}E_5 \text{ ----------(B-5)}$$

The above equations are a representation of the above causal system, and each path coefficient is an index to measure the direct influence along a particular path in the system. The task now is to solve the system of equations to obtain the values of these path coefficients. One of the applicable ways to solve this problem is to express each of the above equations in terms of the correlation coefficients and path coefficients among these variables and then utilize matrix operation to obtain the path coefficients.

The basic theorem of path analysis Before the presentation of the basic theorem of path analysis which allows us to express the system of equations in the correlation and path coefficients frameworks, the author would like to review a computation formula for the correlation coefficient r. If the two variables of X and Y are measured in standardized form (that is, $Z_x = \frac{\Sigma(x - \bar{x})}{S_x}$ and $Z_y = \frac{\Sigma(y - \bar{y})}{S_y}$), then we have $r_{xy} = \frac{\Sigma Z_x Z_y}{n}$. If all the variables in the above set of equations are measured in terms of the standardized form, then the system of equations can be transformed into the following equations:

(11)

$$Z_1 = e_1 \text{ ----------(B-6)}$$

$$Z_2 = e_2 \text{ ----------(B-7)}$$

$$Z_3 = P_{32}Z_2 + P_{31}Z_1 + P_{3a}Z_a \text{ ----------(B-8)}$$

$$Z_4 = P_{43}Z_3 + P_{42}Z_2 + P_{41}Z_1 + P_{4b}Z_b \text{ ----------(B-9)}$$

$$Z_5 = P_{54}Z_4 + P_{53}Z_3 + P_{52}Z_2 + P_{51}Z_1 + P_{5c}Z_c \text{ ----------(B-10)}$$

Since it is a recursive system these equations can be solved separately to obtain path coefficients. One of the common procedures to obtain the p's is to utilize its relationship with correlation coefficient and path coefficient. Let us examine the correlation between variable X_1 and X_2 to show the relationship:

$$r_{31} = \frac{1}{n}\Sigma Z_3 Z_1$$

$$= \frac{1}{n}\Sigma Z_1 (P_{32}Z_2 + P_{31}Z_1 + P_{3a}Z_a)$$

$$= P_{31}\frac{\Sigma Z_1 Z_1}{n} + P_{32}\frac{\Sigma Z_1 Z_2}{n} + P_{3a}\frac{\Sigma Z_1 Z_a}{n}$$

$$= P_{31}r_{11} + P_{32}r_{12} + P_{3a}\frac{\Sigma Z_1 Z_a}{n}$$

Since correlation coefficient of a variable with itself is unity, and the assumption that the residual is uncorrelated with determining variable Z_1, we have: $r_{31} = P_{31}r_{11} + P_{32}r_{12}$. Similarly, $r_{32} = P_{31}r_{21} + P_{32}r_{22}$.

The above procedures can be applied to other equations as well to express the path coefficient. For instance:

$$r_{53} = \frac{1}{n}\Sigma Z_5 Z_3$$

$$= \frac{1}{n}\Sigma Z_3 (P_{54}Z_4 + P_{53}Z_3 + P_{52}Z_2 + P_{51}Z_1 + P_{5c}e_c)$$

$$= P_{54}r_{43} + P_{53} + P_{52}r_{23} + P_{51}r_{31}$$

It should be noted that expansion of the basic theorem of path analysis provides the same results, which can be written in the general form as

$$r_{ij} = \Sigma_k P_{ik}r_{jk} = \Sigma_k P_{ik}r_{kj}$$

Where i and j denote any two variables in the model, and the index k runs all variables from which paths lead directly to Z_i.

By applying the basic theorem the simple correlation between any dependent variable and the preceding independent variables can be expressed as a function of path coefficients and correlation coefficients between any two independent variables. To demonstrate the application of the basic theorem, the author concentrates on the equation (B-10) which includes four path coefficients of P_{54}, P_{53}, P_{52}, and P_{51}. Thus, the author can express the correlation coefficients of r_{54}, r_{53}, r_{52}, and r_{51} in terms of the four path coefficients and other correlation coefficients. Take r_{51} as an example and apply the basic theorem, it becomes

$r_{ij} = \sum_{k=1} P_{ik} r_{jk}$ where i = 5, j = 1, k = 1,2,3,4 in the present case

$$\therefore \quad r_{51} = P_{51}r_{11} + P_{52}r_{12} + P_{53}r_{13} + P_{54}r_{14}$$

$$= P_{51} + P_{52}r_{21} + P_{53}r_{31} + P_{54}r_{41} \qquad (\because r_{11} = 1)$$

Similarly,

$$r_{ij} = r_{52} = \sum_{k=1}^{4} P_{ik} r_{jk} \quad \text{where } i = 5,\ j = 2,\ k = 1,2,3,4.$$

$$= P_{51}r_{12} + P_{52} + P_{53}r_{32} + P_{54}r_{42}$$

Thus, the following path estimation equations are obtained:

$$r_{51} = P_{51} + P_{52}r_{21} + P_{53}r_{31} + P_{54}r_{41} \qquad \text{(B-11)}$$

$$r_{52} = P_{51}r_{12} + P_{52} + P_{53}r_{32} + P_{54}r_{42} \qquad \text{(B-12)}$$

$$r_{53} = P_{51}r_{13} + P_{52}r_{23} + P_{53} + P_{54}r_{43} \qquad \text{(B-13)}$$

$$r_{54} = P_{51}r_{14} + P_{52}r_{24} + P_{53}r_{34} + P_{54} \qquad \text{(B-14)}$$

The set of equations can be expressed in matrix form as follows:

$$\begin{bmatrix} r_{51} \\ r_{52} \\ r_{53} \\ r_{54} \end{bmatrix} = \begin{bmatrix} 1 & r_{12} & r_{13} & r_{14} \\ r_{21} & 1 & r_{23} & r_{24} \\ r_{31} & r_{32} & 1 & r_{34} \\ r_{41} & r_{42} & r_{43} & 1 \end{bmatrix} \begin{bmatrix} P_{51} \\ P_{52} \\ P_{53} \\ P_{54} \end{bmatrix}$$

Now, if we denote the matrix in the left by [R], the first matrix of the right side by [r], and the last matrix by [P], then we have: [R]=[r][P].

The matrix [R] and [r] consists of correlation coefficients that can be computed directly from empirical data, the only unknown values are those path coefficients contained in the matrix [P]. Based on the theory of linear algebra, it can be said that a system of linear equations such as [R] = [r][P] has exactly one solution if and only if the inverse matrix of [r], denoted by $[r]^{-1}$, exists. In general, the matrix [r] is a square matrix, and for a square matrix [r], its inverse Matrix $[r]^{-1}$ exists if and only if [r] is nonsingular. In sum, the solution of path coefficients involves the computation of the inverse matrix [r], and the existence of $[r]^{-1}$ ensures the solution of path coefficients, that is: $[P] = [r]^{-1}[R]$.

It should be noted that there are other alternatives for solving the system of equations. For example, one of the commonly used techniques is a best-fit approach. Moreover, since the value of path coefficients is equivalent to the standardized regression coefficients, the linear regressional analysis is an alternative technique for the solution.

Tracing connecting paths The functional relationships between simple correlations and path coefficients are stated explicitly in the

basic theorem of path analysis discussed above. More intuitively, the process of tracing connecting paths is an alternative way to assess the functional relationship or to examine the total correlation between two variables in a causal model. To show the process of tracing connecting paths, the author assumes that the causal scheme diagramed below is the center of emphasis.

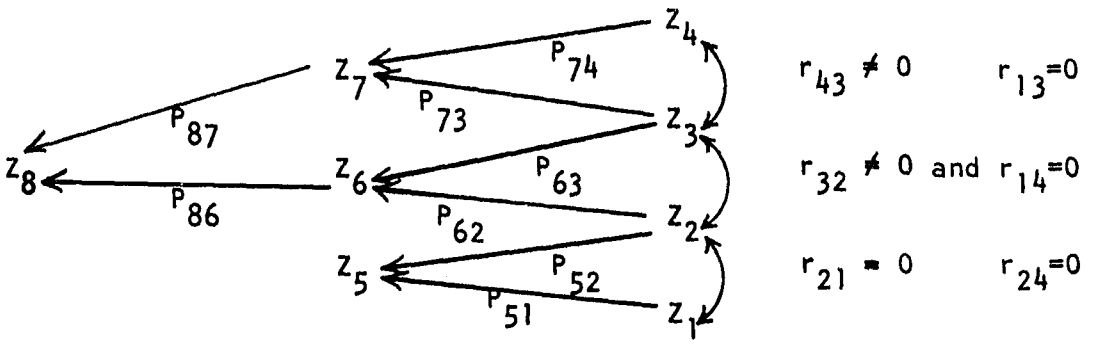


Figure 4.6. Correlations in a complex causal scheme

Li (1955) discusses and provides some simple rules for tracing connecting paths. These are:

1. No "first-forward-and-then-backward" motion in tracing any connecting paths.
2. "First-backward-and-then-forward" is permissible.
3. If one is tracing backward, one can continue to trace backward (no change in direction) for as many steps as are available, and then forward for as many steps as are available, without changing direction.

According to the first rule it can be seen that Z_1 and Z_2 are independent, since, though variable Z_5 is connected with Z_1 and Z_2 by single paths

P_{51} and P_{52} respectively but Z_1 and Z_2 are not correlated by way of variable Z_5. Following the above rules other results can be observed from the causal scheme.

1. The second rule permits a researcher to trace from Z_6 back to Z_2 and then forward to Z_5.
2. The third rule allows a researcher to trace from Z_8 back to Z_6, then back to Z_2 and then forward to Z_5.
3. $r_{51} = P_{51}$ and $r_{52} = P_{52}$
4. $r_{75} = P_{73} \cdot r_{23} \cdot P_{52}$ -- tracing from Z_7 back to Z_3 and tracing from Z_2 forward to Z_5 are permissible. These two paths are connected through the correlation between Z_3 and Z_2.
5. $r_{65} = P_{62}P_{52} + P_{63}r_{23}P_{52}$ -- there are two different connecting paths between Z_5 and Z_6: one route is from Z_6 back to Z_2 and then forward to Z_5, and the other route traces from Z_6 back to Z_3 passing through the correlation between Z_3 and Z_2, then forward to Z_5.
6. $r_{76} = P_{73}P_{63} + P_{73}r_{23}P_{62} + P_{74}r_{34}P_{63}$ -- there are three routes which exist according to the above rules: one by way of Z_3 and then Z_6, the second also by way of Z_3 passing through the correlation between Z_3 and Z_2 and then from Z_2 forward to Z_6, the last one from Z_7 back to Z_4 passing through the correlation r_{34} and then forward to Z_6.

It should be noted that in tracing all the paths connecting two variables, one should avoid duplication of chains. Wright (1960 :193) has stated a principle for tracing connecting paths:

> The correlation between any two variables in a properly constructed path diagram is equal to the sum of the direct and/or indirect routes by which one may trace from one to the other in the diagram without going back after going forward along an arrow and without passing through any variable twice in the same traverse between the two variables. One and only one of the elementary paths in the composition of a given compound path may be a two-headed arrow without violating the rule of never going back after going forward.

The total indirect effect and residual path coefficient

As defined previously the path coefficient P_{ij} is an estimation of the direct affect of a variable Z_i on variable Z_j under the assumption that the relations of the variable Z_i to the other independent variables in the system have been made constant. The concept of total effect of an exogenous variable on an endogenous variable is considered as the simple correlation of the two variables. Thus, it is an indication of the aggregate effect of an exogenous variable on an endogenous variable through all possible direct and indirect paths. The concept of indirect effect is an indication of the aggregate effect of an exogenous variable on an endogenous variable other than the direct effect of the exogenous variables which are specified in the causal model. Thus, the total indirect effect of an exogenous variable Z_i on an endogenous variable is estimated by:

$$\text{Total indirect effect of } Z_i \text{ on } Z_j = r_{ji} - P_{ji}$$

Moreover, the residual path coefficient is an indication of the aggregate effect of all independent variables on a dependent variable that is not explicitly stated in a closed causal model. A path model is closed under the assumption that all sources of variation are explicitly included in the model. The general formula for computing residual path coefficient P_{ia} is:

$$P_{ia}^2 = 1 - \sum_k P_{ik} r_{ki} \qquad \text{or} \qquad P_{ia} = 1 - \sqrt{\sum_k P_{ik} r_{ki}}$$

where the index k runs over all variables from which paths lead directly to variable Z_i

The derivation of the above formula is based on the analysis of the correlation between any dependent variable Z_i and itself. By the basic theorem of path analysis, $r_{33} = 1 = P_{31}r_{31} + P_{32}r_{32} + P_{3a}r_{3a}$. Since the residual is assumed to be independent of Z_1 and Z_2 so that $r_{3a} = P_{3a}$. Then the equation becomes

$$r_{33} = 1 = P_{31}r_{31} + P_{32}r_{32} + P_{3a} = \sum_{k=1}^{2} P_{3k} r_{3k} + P_{3a}^2$$

Thus, by transforming the term P_{3a}^2, the equation becomes

$$P_{3a}^2 = 1 - \sum_{k=1}^{2} P_{3k} r_{3k} \qquad \text{or} \qquad P_{3a} = \sqrt{1 - \sum_{k=1}^{2} P_{ik} r_{ki}}$$

Furthermore, if the squared multiple correlation coefficient is available, the residual path coefficient can be computed by: $P_{ia} = \sqrt{1 - R^2}$.

Basic assumptions of path analysis

Some of the basic assumptions in formulating path models are:

(1) All variables in the model are measured, at least, with interval scale properties. It is true in many situations that sociological variables are measured somewhat between the ordinal and interval scale. It seems likely, as the result of studies (Land, 1969), that gross errors will not be introduced into path models by the use of monotone measures if measures of variables meet the condition of acting as point on intervals.

(2) Effects between variables of interest are linear and additive. The assumption of linearity can be checked by point-plotting procedure. On

the other hand, several transformations may be used to transform data to meet the assumption.

(3) One way causation between variables of interest. Sources of information for the assumption may derive from theoretical knowledge in the substantive field, verified results of past empirical researches, and time sequence of the variables.

(4) Residuals are uncorrelated with any independent variables in a causal model.

(5) Low degree of multicollinearity. That is, independent variables in the path model are uncorrelated or the degree of correlation is negligible if it does exist.

(6) High degree of measurement reliability and validity.

CHAPTER V. DATA ANALYSIS AND RESULTS

Introduction

The author attempts to make this chapter an integration of previous ones such that all those reviewed, sociological theories, theoretically formulated causal models, and various statistical methods discussed in early chapters can be applied and integrated into the following empirical analysis. The data used for the analysis were obtained from the 1965 civil defense research project at Iowa State University. The arrangement of the present chapter includes five areas, and will be presented in the sequence as follows.

First, a brief description of the population and samples used in the empirical analysis was introduced for a better understanding of the data.

Second, product-moment correlations of all variables investigated in the dissertation were computed, and these values were presented in a correlation matrix. In addition, several procedures of factor analysis of the dependent variable (goal attainment) of local civil defense organizations were performed to evaluate the process of combining scores and to test the homogenity of original empirical scores.

The third part of the chapter consists of analysis of variance of each individual equation in a constructed, recursive system and computing path coefficients for each path in the theoretically formulated causal model. The results of these analyses were condensed and summarized in tables and figures.

The fourth part of the present chapter is related to part three. After all path coefficients were obtained, evaluations of the path model were

carried out by utilizing t-test of significant paths in the model. Indirect effects of each variable on other variables and residual path coefficient for each equation were also examined in order to provide more information about the theoretical, formulated causal model in addition to the test of significant paths. Then, organizational theory and/or information obtained from the above data analysis were integrated to determine a final causal model.

The last part of the present chapter makes use of three regression procedures, forward, backward deletion and stepwise regression, to fit or search for a best linear regression model on the basis of 14 independent variables to predict and/or explain the variability of official goal achievement of local civil defense organizations. Three different frameworks or model specifications were employed corresponding to the application of the above three different regression procedures. In particular, the ordinary regression analysis was used to analyze the completely specified model in which eight independent variables were included based on prior theoretical knowledge or verified research results from the substantive field. The forward regression and backward deletion regression procedures were applied to the incompletely specified model, and the stepwise regression procedure were employed under the unspecified model specification.

Research Population and Samples

The technique of random, stratified sampling was utilized in selecting sample units of local civil defense organizations based on states' master lists which included both paid and voluntary directors in the three states of Minnesota, Georgia, and Massachusetts. These selected units served as

representative samples of the industrialized midwest, northeastern, and the southeast states. A total of 69 counties' and 171 municipalities' civil defense units consists of the representative samples in the study. The empirical data used in the dissertation were developed from the interview schedules administered to the originally selected 270 directors of local civil defense units. Approximately 90 percent or 240 directors of the original samples were interviewed and applicable for analysis, of which 76 units were in the state of Minnesota, 80 units were in Georgia, and 84 units were in the state of Massachusetts. More detailed description of the population and samples can be found in the monograph of Local Civil Defense Directors' Role Performance (Klonglan, et al., 1966).

Correlation Matrix and Factor Analysis

Correlation coefficients for variables in the study

In the beginning of this empirical analysis the author first explored the patterns and strength of the linear relationships between the dependent variable (goal attainment) and the 14 independent variables by computing and examining their production-moment correlation coefficients. The exploratory investigation of these correlations should provide some information or clues for latter regression and path analysis.

The product-moment correlation coefficient was developed by Karl Pearson as a measure of the degree of closeness of the linear relationship between two variables. A very weak or practically insignificant correlation coefficient between any two variables indicates that little or no linear relationship between two variables exists, so that regression analysis of these two variables provides meaningless results. The correlation

coefficient is an absolute unit ranging from negative unity to positive unity. Moreover, another advantage of the coefficient is that its computation does not limit one to those cases where the scale value of two variables are the same.

A matrix containing all possible correlation coefficients was constructed and presented in Table 5.1. Several interesting results are observed in examining this correlation matrix. First, all correlation coefficients are positive values. Second, the highest value of the correlation coefficient is 0.9398 which occurs between variable X_1 (size) and variable X_2 (facility). This high value indicates that a larger amount of budget of a local civil defense organization is nearly perfectly associated with a large population size within the local civil defense area, and vice versa. On the other hand, the lowest value is 0.0014, which occurred between variable X_1 and variable X_{10} (socialization).

Third, the eight independent variables of "size," "facility," "representation," "complexity," "communication," "institutionalization," "intra-organizational coordination" and "interorganization relations" which were included in the theoretically formulated causal model, have a relatively high correlation coefficient with the dependent variable. Since the simple correlation coefficients were treated as the approximation of direct effect from these independent variables to the dependent variable, the relatively high values of these coefficients provide some support for doing path analysis. These values are those underlined ones at the last row of Table 5.1. Among these values the highest is 0.6777 between "institutionalization" and "goal attainment"; and the lowest value is 0.2185 which occurred between "size" and "goal attainment."

Table 5.1. Correlation matrix of all 15 variables investigated in the dissertation

	X_1(SI)	X_2(FA)	X_{15}(SPC)	X_4(COP)	X_{14}(NOR)	X_{11}(SNT)	X_{12}(MOR)	X_5(COM)	X_7(IOC)	X_8(IOE)
X_1 (SI)	1.0									
X_2 (FA)	.9398	1.0								
X_{15}(SPC)	.2449	.3018	1.0							
X_4 (COP)	.2195	.2493	.3570	1.0						
X_{14}(NOR)	.1437	.1677	.1458	.1923	1.0					
X_{11}(SNT)	.1181	.1303	.0952	.2494	.2303	1.0				
X_{12}(MOR)	.0957	.0867	.1485	.2123	.2248	.4041	1.0			
X_5 (COM)	.1576	.1552	.1295	.1700	.2922	.4176	.3730	1.0		
X_7 (IOC)	.2529	.2560	.2281	.3437	.2587	.5139	.4495	.4870	1.0	
X_8 (IOE)	.1651	.1653	.1631	.2204	.1650	.2390	.2783	.3174	.5365	1.0
X_3 (RP)	.2229	.2266	.2042	.1975	.1350	.2236	.1904	.3145	.4231	.3785
X_{10}(SOC)	.0014	.0116	.0566	.1985	.0561	.3386	.3943	.3956	.4531	.2640
X_6 (INST)	.2681	.3290	.2382	.4182	.3629	.5782	.4627	.3636	.6214	.2500
X_{13}(SLT)	.1920	.1934	.2019	.1739	.2099	.2069	.2359	.2427	.2716	.1895
X_9 (GA)	.2185	.2657	.1868	.4040	.3352	.5894	.4180	.4065	.5671	.3755

Table 5.1. (Continued)

	X_3(RP)	X_{10}(SOC)	X_6(INST)	X_{13}(SLT)	X_9(GA)
X_3 (RP)	1.0				
X_{10}(SOC)	.1818	1.0			
X_6 (INST)	.2796	.4117	1.0		
X_{13}(SLT)	.1942	.2881	.3312	1.0	
X_9 (GA)	.2649	.4007	.6777	.2900	1.0

X_1 : Size (SI)

X_2 : Facility (FA)

X_3 : Representation (RP)

X_4 : Complexity (COP)

X_5 : Communication (COM)

X_6 : Institutionalization (INST)

X_7 : Intraorganizational Coordination (IOC)

X_8 : Interorganizational Relation (IOE)

X_9 : Goal Attainment (GA)

X_{10} : Socialization (SOC)

X_{11} : Sanction (SNT)

X_{12} : Morale (MOR)

X_{13} : Selectivity (SLT)

X_{14} : Norms (NOR)

X_{15} : Ecology (Space, SPC)

Fourth, the correlation coefficients of "goal attainment" and those variables not included in the theoretically formulated model are relatively moderate as compared with the above ones. The highest value is with "sanction," and then in the following order: "morale," "socialization," "norm," "selectivity," and "ecology." The order of these values yields some useful information in assessing the entering sequence of these variables into latter regression analysis under the incompletely specified model. One last point to be made clear is that the square of the correlation coefficient represents the proportion of the total variation in the one variable explained by the other. Another way of saying this is that the higher the correlation coefficient, the higher the degree these two variables measure the same thing. However, in a set of related variables, such as in the present study, these simple correlation coefficients should be regarded only as preliminary investigation since the interaction between two or more variables might have a great impact on the effects of these related variables.

Factor analysis of the dependent variable

Factor analysis is a technique to determine or test the existence of underlying variable(s)--it is usually referred to as factors in psychological terms--that accounts for the interrelationships among a large number of empirical indices or original variables. Thus, its most immediate usage is to condense large amounts of data into a more concise, interpretable form. More detailed discussion of the technique and applications has been presented in Chapter VI of the dissertation.

The concept of goal attainment was operationalized as the degree to which official goals are accomplished, and was used as the dependent

variable in later analysis. As described in Chapter VI, an empirical index of the concept was constructed by combining the seven scores which were obtained by measuring seven official task areas of local civil defense organizations. In doing so, one may question whether the process of combining together these scores is valid or whether the combined scores are the best indicators as compared with the empirical variables measuring the same concept. Since each of the seven task areas can be viewed as more concrete, specific empirical variables measuring different dimension of the concept, the technique of factor analysis was used to examine the process of combining these seven scores together and to test whether they are homogeneous in nature such that they can be added together to form a better index than each original variable. A positive result of the analysis would legitimize the process of combining these seven task areas' scores.

It is the author's opinion that the procedure of measurement is a very important step in any empirical, quantitative study of sociological phenomena. If measures in a sociological investigation are not formulated properly, the result of application of statistical methods to the data would provide false information about the sociological phenomena. In order to evaluate the procedure of measurement, many empirical social researchers construct multiple indicators or replication scores such that the multitrait-multimethod matrix can be constructed to examine convergent and discriminant validation (Campbell and Fiske, 1959). However, the author believes that factor analysis is a useful technique and can be utilized to test the homogenity of original data and to evaluate the process of combining original empirical variables if a composite score was produced by adding together all individual scores. Moreover, factor analysis also provides other

valuable information such as the factor loadings provide the weight of the underlying variable(s) in determining the presence of the original scores. And the concept of communality gives the total amount of variance in the original scores accounted for by the underlying variable(s).

The first step in performing the factor analysis is to construct a correlation matrix containing all possible simple correlations between the original empirical variables. The computations were carried out by computer and the matrix is shown in Table 5.2. As mentioned previously factor analysis is a method for interpreting sets of intercorrelations between original variables and indicating how much of variation in each of the original variables is associated with the hypothetical general variable(s). In order to achieve this purpose a rule of thumb should be imposed on the average value of all correlation coefficients (product-moment correlation coefficient in the present study). That is, the average value should at least be equal to the absolute value of 0.20. Since the average value of all the correlation coefficients shown in Table 5.2 is over 0.20, it apparently meets the criterion.

In the case of direct solution, the next step in performing the method of factor analysis is to specify, on the basis of prior knowledge from the substantive field or the pattern of correlation coefficients obtained from the first step, certain hypothetical variable(s) that are different linear combinations of original empirical variables. Since the purpose of doing factor analysis in the present study is to test the homogenity of original variables and the legitimacy of the process of combining together these seven task areas' scores for a better index of official goal

Table 5.2. The upper half correlation matrix for seven official task areas

	Y_1 (Task I)	Y_2 (Task II)	Y_3 (Task III)	Y_4 (Task IV)	Y_5 (Task V)	Y_6 (Task VI)	Y_7 (Task VII)
Y_1 (Task I)	1.0	.069	-.064	-.061	.137	.026	-.072
Y_2 (Task II)		1.0	.244	-.389	.496	.748	.405
Y_3 (Task III)			1.0	.445	.257	.326	.309
Y_4 (Task IV)				1.0	.469	.481	.530
Y_5 (Task V)					1.0	.449	.421
Y_6 (Task VI)						1.0	.439
Y_7 (Task VII)							1.0

achievement of local civil defense organizations, the author specified that the first underlying variable is simply a linear combination of these seven scores with equal weight of units. Furthermore, in order to contrast the first general variables, two other general variables are specified by a linear combination of the first three task areas' score and by a linear combination of the last four task areas' scores respectively, all having unity weights. Under the specification of these three hypothetical general variables, the multiple centroid solution was employed to perform factor analysis on the data. Mathematically, these three hypothetical general variables can be written as follows:

$$\text{General variable A} = X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7$$

$$\text{General variable B} = X_1 + X_2 + X_3$$

$$\text{General variable C} = X_4 + X_5 + X_6 + X_7$$

Note again that the general variable A represents exactly the combined scores which were used as the empirical measures of the dependent variable in the dissertation. The results of factor analysis using the orthogonal group centroid factor solution with successive computation of residual matrix is shown in Table 5.3. Those values in the table are factor loadings, indicating the relative weight of each general variable in determining the presence of scores on each individual variable. The most interpretable results found in the analysis were those sum of squared loadings and mean of the sum of squared loadings for the three general variables; especially the general variable A which accounted for about 44 percent of the total variance and a mean of the sum squared loadings equal to 6.25. It shows that the general variable A alone is the most important and significant index of

Table 5.3. The multiple group centroid factor analysis of seven task areas measuring official goal attainment

Original Variable	General Variable A	General Variable B	General Variable C	Communality
Y_1(Task I)	.2324	.6151	.0013	.4325
Y_2(Task II)	.7517	.1426	-.0010	.5854
Y_3(Task III)	.5644	.2920	-.0003	.4039
Y_4(Task IV)	.7293	-.3399	-.0022	.6473
Y_5(Task V)	.7240	-.2201	.0020	.5725
Y_6(Task VI)	.7780	-.0990	-.0017	.6151
Y_7(Task VII)	.6798	-.3908	-.0023	.6149
Sum of square loadings	43.7293	11.5785	.0003	55.3081
Average sum of square loadings	6.25	1.65	.0000	

the official goal achievement, as compared with the other two general variables B and C. The two general variables B and C together account for only 11.58 percent of the total variance. Judging the outcome of the orthogonal group centroid method, the general variable A, which was used as the index of the dependent variable in the theoretically formulated causal model and regression analysis, is one of the most significant underlying variables that account for the largest proportion of variation for the original seven task areas. Furthermore, each of the seven original empirical variables except the first was loaded highly on the general variable A as shown in the first column of the above table. In conclusion, the result of the factor analysis by orthogonal group centroid solution does support the process

of combining these original variables together as an index of the concept of "goal attainment" since the general variable is the most powerful one in explaining the total variance.

There is another useful solution which is called stepwise solution for determining general factors (variables) without a prior specification of the relative weights on each original empirical variable. That is, a researcher, in performing factor analysis, doesn't specify the nature of linear combinations among the individual variables except the indication of how many general variables should be extracted if a researcher prefers to use a stepwise solution. The first step in doing the solution is to condense the data which was carried out by principle axes method in the present study. The second step in the solution is to rotate the factors derived from the first step. The rotation was achieved by Kaiser's varimax method in the present study. In fact, these two methods are used together to derive simple structure for better understanding of the nature of the original empirical variables. In a simple structure each original empirical variable loads highly on only one general variable and loads very low on others such that it makes interpretation much easier.

The result of the factor analysis by the principle axes solution produced Table 5.4 which contains three hypothetical general variables and their factor loadings. Again, the table shows that there is only one most dominated general variable, A_p, that takes care of a significant amount of total variance. Moreover, the factor loadings on general variable A_p are very high except the one loading on task area 1.

The varimax rotation solution to factor analyze the data derived from principle axes appears in Table 5.5. It shows the values of factor loadings

Table 5.4. Principle axes solution to factor analysis of seven task areas of local civil defense organizations

Original Variable	General Variable A_p	General Variable B_p	General Variable C_p
Y_1(Task I)	.0198	.8751	.4355
Y_2(Task II)	.7770	.2552	-.3969
Y_3(Task III)	.5515	-.35-5	.5646
Y_4(Task IV)	.7609	-.2285	.2414
Y_5(Task V)	.7157	.2484	.0608
Y_6(Task VI)	.8129	.1339	-.3148
Y_7(Task VII)	.7124	-.1925	.0233
Sum of square loadings	45.2544	16.0387	11.8222
Average sum of square loadings	6.4649	2.2912	1.6888
Eigen-Value	3.168	1.123	.828

and percent of total variance removed by three general variables. It becomes obvious by observing the Table that 68.84 percent of total variance was accounted for by general variable A_R which is rotated factor A. Since there is only one significant underlying variable that accounts for a large portion of the total variance, the author concludes that these seven task areas are quite homogeneous and the results support the process of combining these seven original empirical variables together to indicate the variability of the concept (goal attainment) empirically.

Table 5.5. Rotated factor loading matrix (normalized) by varimax rotation

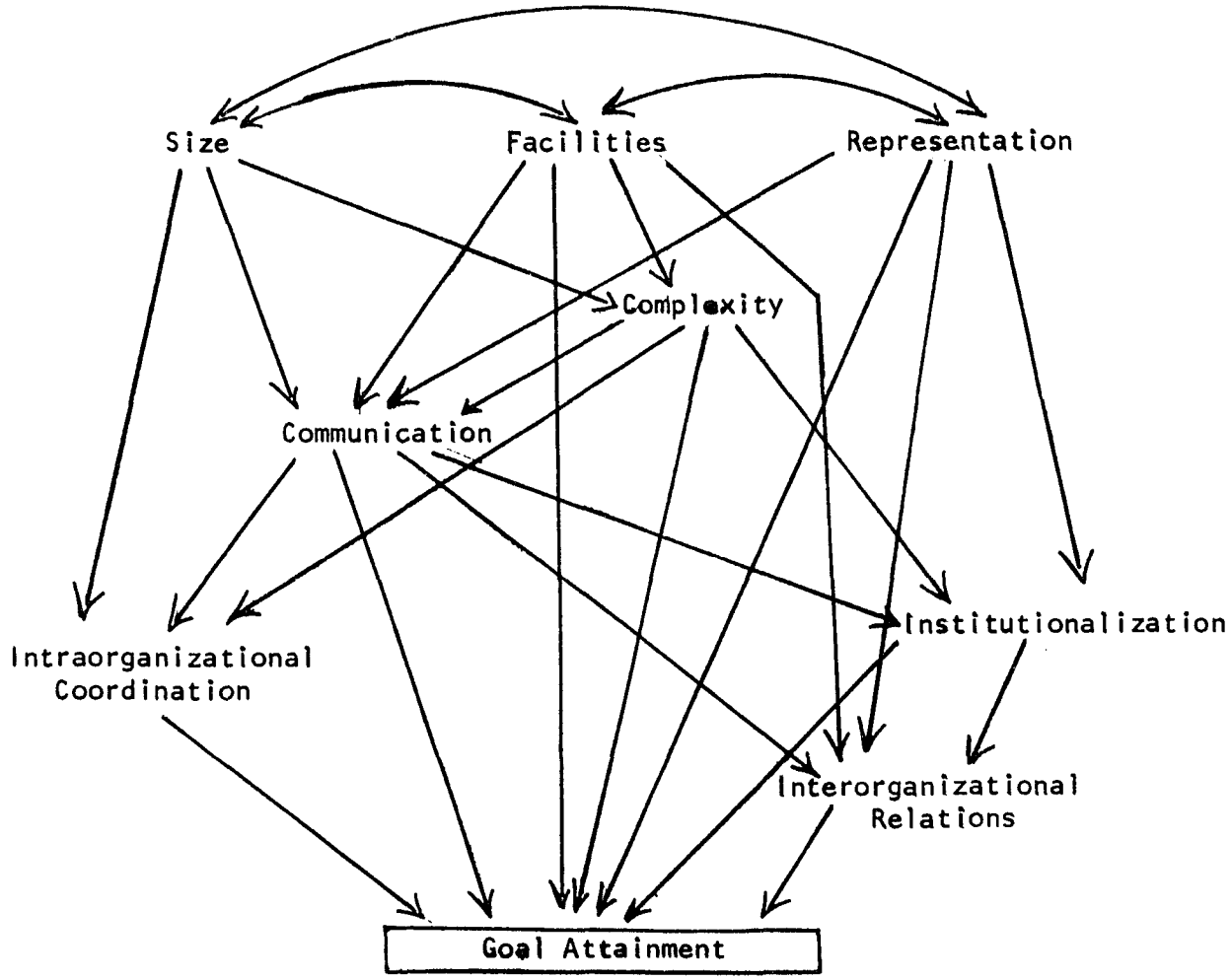
Original Variable	General Variable A_R	General Variable B_R	General Variable C_R
Y_1(Task I)	.29895	.95426	.00010
Y_2(Task II)	.82936	.55869	.00005
Y_3(Task III)	.75325	.65773	.00007
Y_4(Task IV)	.94751	.31972	.00004
Y_5(Task V)	.92403	.38231	.00004
Y_6(Task VI)	.89380	.44846	.00005
Y_7(Task VII)	.96085	.27705	.00003
Percent of total variance removed	68.83365	31.16633	.00000

Path Coefficients and Path Model Testing

The path coefficients for paths in the theoretically formulated causal model, discussed in Chapters III and IV, were based on the empirical data of local civil defense organizations. The first step to compute the path coefficients and/or validating the path model is to write out the recursive system of equations which is a mathematical expression of the functional relationships of all variables included. The author will first demonstrate how the recursive system of equations in the present study was constructed in the following pages.

Recursive system of equations with standardized variables

Following the theory of path analysis discussed in Chapter IV and the theoretically constructed causal model diagrammed in Figure 5.1, the author



Note: Totally 15 concepts are defined, and their cause and effect relations are formulated. These 15 organizational concepts include "goal attainment," "interorganizational relations," "intraorganizational coordination," "communication," "institutionalization," "complexity," "size," "facilities," "representation," "norms," "sanction," "selectivity," "socialization," "morale," and "ecology." Only the first nine concepts are included in the causal model being developed. The additional six concepts are for additional testings.

Figure 5.1. Theoretically formulated causal model

expressed the causal model in terms of the recursive system of equations as follows:

$$Z_1 = e_a$$

$$Z_2 = e_b$$

$$Z_3 = e_c$$

$$Z_4 = P_{41}Z_1 + P_{42}Z_2 + P_{4d}Z_d$$

$$Z_5 = P_{51}Z_1 + P_{52}Z_2 + P_{53}Z_3 + P_{54}Z_4 + P_{5e}Z_e$$

$$Z_6 = P_{63}Z_3 + P_{64}Z_4 + P_{65}Z_5 + P_{6f}Z_f$$

$$Z_7 = P_{71}Z_1 + P_{75}Z_5 + P_{74}Z_4 + P_{7g}Z_g$$

$$Z_8 = P_{82}Z_2 + P_{83}Z_3 + P_{85}Z_5 + P_{86}Z_6 + P_{8h}Z_h$$

$$Z_9 = P_{92}Z_2 + P_{93}Z_3 + P_{94}Z_4 + P_{95}Z_5 + P_{96}Z_6 + P_{97}Z_7 + P_{98}Z_8 + P_{9i}Z_i$$

Where the P's in the equations are the path coefficients, the first subscript under each P stands for the effect and the second subscript denotes the cause. Thus, P_{51} is the path coefficient for the path leading from variable Z_5 to the variable Z_1 in the model. The Z's are explained in the following:

Variables in the model	Corresponding Symbol	Concept Operationalized
Z_1	X_1 (SI)	Size
Z_2	X_2 (FA)	Facility
Z_3	X_3 (RP)	Representation
Z_4	X_4 (COP)	Complexity
Z_5	X_5 (COM)	Communication
Z_6	X_6 (INST)	Institutionalization
Z_7	X_7 (IOC)	Intra-org. Coordination

Variables in the model	Corresponding Symbol	Concept Operationalized
Z_8	X_8 (IOE)	Inter-org. Relation
Z_9	X_9 (GA)	Goal Attainment

Assumption for computing path coefficients

Variable assumptions:

(1) Variables in the model are measured, at least, at interval scale level.

(2) Measures of the variables are valid representation of the concept.

Model assumptions:

(1) The effects of independent variables are both linear and additive relationships.

(2) Error terms are uncorrelated in order to yield unbiased and efficient estimators of path coefficients by ordinary least squares procedures.

(3) Error terms are normally distributed if significant tests are desired.

(4) Asymmetrical causal relationships between variables in the model.

More detailed discussion about the assumptions were presented in Chapter IV.

Analysis of variance for individual equations in the causal model

It would be a worth-while effort to test whether each individual equation in the recursive system contributes significantly in "producing" the variance of its dependent variable before computing their path coefficients

in the equations. The tests to be employed are the F-ratio test which is closely related to the method of analysis of variance. Six F tests were performed for the six individual equations in the above recursive system. The results of the analysis including the multiple R squares are condensed and summarized in Table 5.6.

Comparing with the tabulated F values, the author found that all the computed F ratios in Table 5.6 were significant at the .05 level. These statistical significances of F values indicate that each set of independent variables in the equations contributed significantly in explaining the variation in the dependent variables (goal attainment) and the multiple R squares, ranging from 54 percent to seven percent, tell us what the percentage of the variation explained by these independent variables in that particular equation is.

Computation of path coefficients in the theoretically formulated model

In general, the computation of path coefficients in a causal model should follow the procedures discussed in Chapter IV. That is, applying the basic theorem of path analysis to form a set of the path estimation equations in terms of correlation coefficients and path coefficients so that matrix operations can be employed to solve these equations and to obtain the values for the path coefficients in the equations. However, due to the recursive nature of the related equations, a best-fit approach can be used to obtain a "least-squares averaging" solution for these path coefficients in each of the individual equations in the recursive system. The actual computation of these path coefficients in the present study was carried out by electrical computer based on the least-squares averaging method. Consequently, the values of these path coefficients are equivalent to the

Table 5.6. Analysis of variance of equations in the recursive system

Dependent Variable	Independent Variables	Variation due to	Degree of freedom	Mean Squares	F Value	R Square
X_9(GA)	X_2(FA)	Total	239			
	X_4(COP)	Regression	7	4723405.91	38.11**	.54
	X_5(COM)	Residual	232	123946.08		
	X_7(IOC)					
	X_8(IOE)					
	X_3(RP)					
	X_6(INST)					
X_8(IOE)	X_2(FA)	Total	239			
	X_5(COM)	Regression	4	1440.57	14.40**	.20
	X_3(RP)	Residual	235	100.06		
	X_6(INST)					
X_7(IOC)	X_1(SI)	Total	239			
	X_4(COP)	Regression	3	20522.91	37.67**	.33
	X_5(COM)	Residual	236	544.80		
X_6(INST)	X_4(COP)	Total	239			.28
	X_5(COM)	Regression	3	609.35	30.19**	
	X_3(RP)	Residual	236	20.18		
X_5(COM)	X_1(SI)	Total	239			.12
	X_2(FA)	Regression	4	5220.93	7.71**	
	X_4(COP)	Residual	235	676.91		
	X_3(RP)					

Table 5.6. (Continued)

Dependent Variable	Independent Variables	Variation due to	Degree of freedom	Mean Squares	F Value	R Square
X_4(COP)	X_1(SI)	Total	239	4655.87		
	X_2(FA)	Regression	2	574.16	8.11**	.07
		Residual	237			

**Significant under .05 level, i.e., 3.03.

standardized regression coefficients under the method. Table 5.7 contains values for these path coefficients (that is labeled with the standardized partial regression coefficients), T values, standard error, and partial regression coefficients.

As mentioned previously, path coefficients are the indication of the direct effect of an independent (exogenous) variable on its corresponding dependent (endogenous) variable. Another important property of a path coefficient is that since it is measured in standardized form to have a mean of zero and common variance of unity, those path coefficients for the paths leading to the same dependent variable can be compared with each other for a better understanding of their relative effects in producing the variance on the same dependent variable. Following this rationale the author interprets that, in the last equation where the dependent variable is the official goal achievement of local civil defense organizations, the effect of the variable Z_6 (institutionalization) was about three times of the direct effect of variable Z_8 (interorganizational relation) on the same dependent variable. On the other hand, variable Z_4 (complexity) produced about the

Table 5.7. Correlation coefficients and analysis of variance for the recursive system of equations

Dependent Variable	Independent Variables	R Value	Partial Regression Coefficient	T Value	Standard Partial Regression Coefficient (path coefficient)
X_4(COP)	X_1(SI)		-0.000	-0.69	-0.13
	X_2(FA)	0.25	0.001	2.00**	0.36
	Constant		10.317	---	---
X_5(COM)	X_1(SI)		0.000	0.50	0.09
	X_2(FA)		-0.000	-0.09	-0.02
	X_4(COP)	.34	0.111	1.55	0.10
	X_3(RP)		1.900	4.37**	0.28
	Constant		76.609	---	---
X_6(INST)	X_4(COP)		0.074	6.12**	0.35
	X_5(COM)	.53	0.051	4.50**	0.27
	X_3(RP)		0.167	2.17**	0.13
	Constant		1.339	---	---
X_7(IOC)	X_1(SI)		0.000	2.40**	0.13
	X_4(COP)	.57	0.277	4.37**	0.24
	X_5(COM)		0.437	7.76**	0.43
	Constant		13.085	---	---
X_8(IOE)	X_2(FA)		0.000	0.68	0.04
	X_5(COM)		0.077	2.93**	0.19
	X_3(RP)	.44	0.783	4.50**	0.28
	X_6(INST)		0.184	1.32	0.09
	Constant		92.117	---	---

Table 5.7. (Continued)

Dependent Variable	Independent Variables	R Value	Partial Regression Coefficient	T Value	Standard Partial Regression Coefficient (path coefficient)
X_9(GA)	X_2(FA)		0.001	0.30	0.01
	X_4(COP)		2.366	2.28**	0.11
	X_5(COM)		2.295	2.38**	0.12
	X_7(IOC)	.73	1.607	1.28	0.09
	X_8(IOE)		6.847	2.71**	0.15
	X_3(RP)		-4.162	-0.64	-0.03
	X_6(INST)		48.087	8.07**	0.50
	Constant		80.112	---	---

**Significant at .05 level, i.e., 1.96.

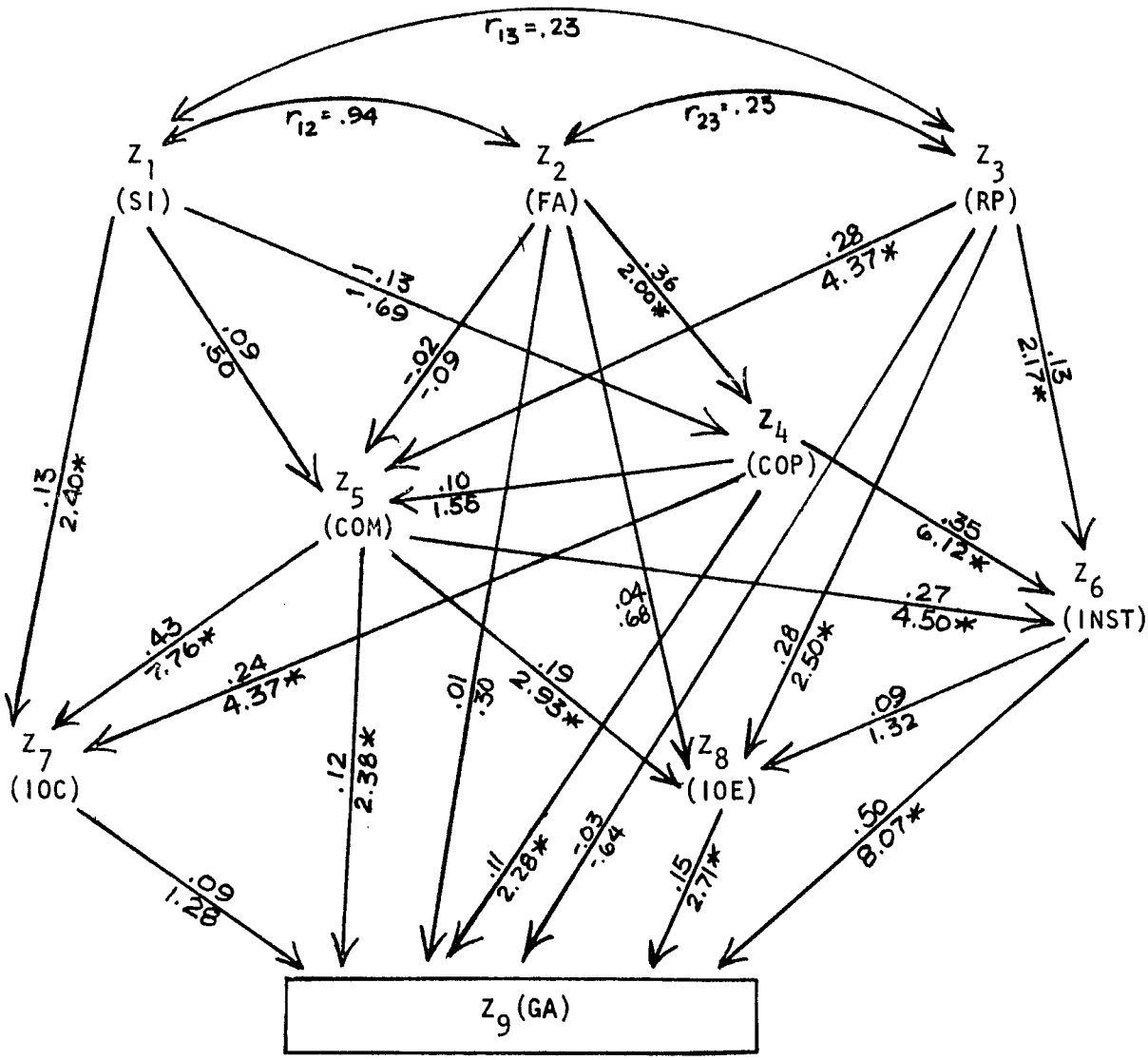
same amount of variation on the dependent variable X_9 (goal attainment) as variable X_7 (intraorganizational coordination) did.

In order to provide a more complete and more clear view of these direct effects the Figure 5.2 was constructed with all path coefficients attached on each corresponding path. The T values are also shown for the corresponding path coefficients in the figure.

Evaluation of Path Model

Test of significant paths

In the process of path analysis, causal orderings in the path model were formulated on the basis of prior theoretical knowledge from sociological theory and past research on organizations, and then the corresponding path coefficients were computed using the empirical data of local civil



*Significant at .05 level by two-tails test.

Figure 5.2. The path model with path coefficients and T-values

defense organizations. However, in order to determine whether these direct effects (path coefficients) were true effects or due to sampling error, we should apply certain significance tests on these coefficients. Duncan (1966) has suggested a straight forward method to test the significance of path coefficients by utilizing t-tests on corresponding B's. Had some of

the B's turned out both non-significant and neglibible in magnitude, then the researcher could have dropped these corresponding paths from the model and recompute those path coefficients for significant paths. These procedures can be performed repeatedly until all path coefficients in the causal model are significant at predesignated probability levels. Following Duncan's suggestion, the author first compared the calculated t values with tabulated t values, and found out that 14 out of the original 23 paths specified in the causal model were significant at the five percent level by the two-tail test. The author further worked on the second analysis to perform analysis of variance on each equation in the recursive system by setting those insignificant paths equal to zero. The results of these analyses of variance are shown in Table 5.8. The last work was to run regression analysis again to solve the recursive system of equations. Table 5.9 summarized the result of the regression analysis, in which the constant terms, partial regression coefficients, t-values and standardized partial regression coefficients (path coefficients) are included. In addition to these two tables, the author diagrammed the causal model in Figure 5.3 with path coefficients and t values for the significant paths again. Note that the nine insignificant paths were included also in the present model but indicated by dotted lines so that they can be distinguished from those actual significant paths.

Total effects, total indirect effects and residual path coefficients

As discussed in Chapter IV, the total effect of an exogenous (independent) variable Z_i on an endogenous (dependent) variable Z_j is approximated by the simple correlation r_{ij} of these two variables. Moreover, path coefficient P_{ij} is the approximation of direct effect from Z_i to Z_j. Thus the

Table 5.8. R squares and analysis of variance of significant path in recursive system of equations

Dependent Variable	Independent Variable	Variation due to	df	Mean Square	F Value	R	R Square
X_4(COP)	X_2(FA)	Regression	1	9039.13	15.78**	.25	.063
		Residual	238	572.90			
X_5(COM)		Regression	1	17795.70	26.12**	.32	.099
	X_3(RP)	Residual	238	681.35			
X_6(INST)	X_4(COP)	Regression	3	609.35			
	X_5(COM)	Residual	236	20.18	30.19**	.52	.277
	X_3(RP)						
X_7(IOC)	X_1(SI)	Regression	3	20522.91			
	X_4(COP)	Residual	236	544.79	37.67**	.55	.324
	X_5(COM)						
X_8(IOE)	X_5(COM)	Regression	2	2736.26	27.24**	.43	.187
	X_3(RP)	Residual	237	100.43			
X_9(GA)	X_4(COP)	Regression	4	8207532.07	66.53**	.73	.531
	X_5(COM)	Residual	235	123358.31			
	X_8(IOE)						
	X_6(INST)						

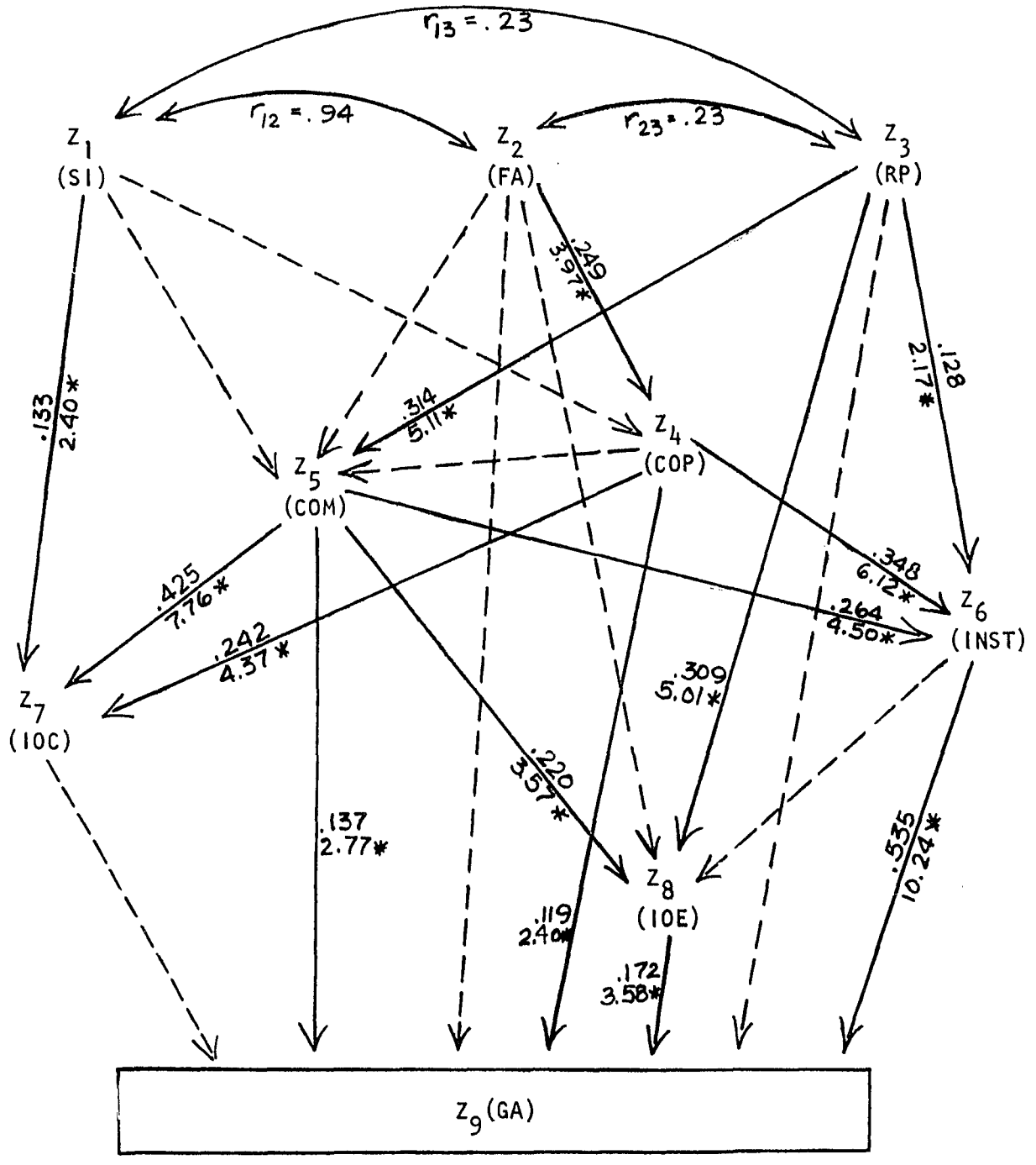
**Significant at .05 level.

value of $(r_{ij} - P_{ji})$ should approximate the total indirect effect of variable Z_i on Z_j by way of other related variables. Since we interpret the

Table 5.9. F values, T values and path coefficients for significant path in general causal model

Dependent Variable	Independent Variables	F Value	Partial Regression Coefficients	T Values	Standard Partial Regression Coefficient (path coefficient)
X_4(COP)	X_2(FA)	15.78**	.001	3.97**	.249
	Constant		10.277		
X_5(COM)	X_3(RP)	26.12**	2.144	5.11**	.314
	Constant		76.671		
X_6(INST)	X_4(COP)		0.007	6.12**	.348
	X_5(COM)	30.19**	0.005	4.50**	.264
	X_3(RP)		0.167	2.17**	.128
	Constant		1.339		
X_7(IOC)	X_1(SI)		0.001	2.40**	.133
	X_4(COP)	37.67**	0.277	4.37**	.242
	X_5(COM)		0.437	7.76**	.425
	Constant		13.085		
X_8(IOE)	X_5(COM)		0.009	3.57**	.220
	X_3(RP)	27.24**	0.850	5.01**	.309
	Constant		92.106		
X_9(GA)	X_4(COP)		2.455	2.40**	.119
	X_5(COM)		2.541	2.77**	.137
	X_8(IOE)	66.53**	7.901	3.58**	.172
	X_6(INST)		51.826	10.24**	.535
	Constant		-23.512		

**Significant at .05 level of two-tails test.



*Significant at .05 level by two-tails test.

Figure 5.3. Path coefficients and T values for significant paths in general causal model

concept of residual path coefficient as the aggregate effect of all independent variables on a dependent variable that is not explicitly specified in a closed causal model, the formula for computing residual path coefficient is: $P_{ia}^2 = 1 - \sum_k P_{ik} r_{ki}$ or $P_{ia} = \sqrt{1 - R^2}$. Following these formulas the author computed the total effects, direct effects and total indirect effects. These values are condensed and summarized in Table 5.10. The residual path coefficients are as follows: $P_{4d} = .93$, $P_{5e} = .88$, $P_{6f} = .72$, $P_{7g} = .67$, $P_{8h} = .80$ and $P_{9i} = .46$.

The application of path analysis not only provides a technique to compute direct and indirect effect but also gives a meaningful interpretation of a correlation coefficient between two variables as a sum of the direct and indirect effects. As mentioned in the methodological chapter, total effect (correlation coefficient) is regarded as an indication of the aggregate effect of an independent (exogenous) variable on a dependent (endogenous) variable through all possible direct and indirect paths. Thus, in evaluating how important an independent variable is in terms of its effect on a dependent variable in a causal model, a researcher should look into the amount of direct effect (path coefficient) as well as the amount of indirect effect. A close examination of Table 5.10 reveals several important facts about the direct and indirect effects:

1. Though the variable Z_1 (size) was assumed theoretically to have no direct effect on goal attainment, the actual computation of its indirect effect reveals that it has a value of .22 which is relatively significant.

Table 5.10. Total effect, direct and indirect effect of each independent variable in the general causal model

Independent Variable	Dependent Variables	Total effect (r_{ij})	Direct effect (P_{ji})	Total indirect effect ($r_{ij}-P_{ji}$)
Z_1(SI)	Z_4(COP)	$P_{41} + r_{12}P_{42} = .22$	$P_{41} = -.13$	.35
	Z_5(COM)	$P_{51} + r_{12}P_{52} + r_{13}P_{53} + r_{12}P_{42}P_{54} = .16$	$P_{51} = .09$	.07
	Z_7(IOC)	$P_{11} + P_{51}P_{75} + P_{41}P_{74} + \text{--------} = .26$	$P_{71} = .13$	.13
	Z_9(GA)	$P_{71}P_{91} + P_{51}P_{91} + \text{----------} = .22$	$P_{91} = .00$	.22
Z_2(FA)	Z_4(COP)	$P_{42} + r_{12}P_{41} = .25$	$P_{42} = .36$	-.11
	Z_5(COM)	$P_{52} + r_{12}P_{51} + r_{23}P_{53} + P_{42}P_{54} = .17$	$P_{52} = .02$	.19
	Z_8(IOE)	$P_{82} + r_{23}P_{83} + P_{52}P_{85} = .17$	$P_{82} = .04$	.13
	Z_9(GA)	$P_{92} + P_{52}P_{95} + P_{42}P_{94} + r_{23}P_{93} + \text{---}$		
		$\text{---} + r_{23}P_{63}P_{96} + r_{12}P_{71}P_{97} = .27$	$P_{92} = .01$	.26
Z_3(RP)	Z_5(COM)	$P_{53} + r_{23}P_{52} + r_{23}P_{42}P_{54} + r_{13}P_{51} = .32$	$P_{53} = .28$	.04
	Z_6(INST)	$P_{63} + P_{53}P_{65} + r_{23}P_{42}P_{64} + \text{---}$		
		$\text{---} + r_{13}P_{42}P_{64} + r_{13}P_{51}P_{65} = .28$	$P_{63} = .13$	.15
	Z_9(GA)	$P_{93} + P_{63}P_{96} + P_{63}P_{86}P_{98} + \text{---}$		
		$\text{---} + r_{23}P_{52}P_{95} + \text{--------} = .27$	$P_{93} = -.03$	.30

Table 5.10. (Contined)

Independent Variable	Dependent Variables	Total effect (r_{ij})	Direct effect (P_{ji})	Total indirect effect (r_{ij}-P_{ji})
Z_4(COP)	Z_5(COM)	$P_{54} + P_{42}P_{52} + P_{42}r_{12}P_{51} + P_{42}r_{23}P_{53} +$ --- $+ P_{41}r_{12}P_{52} + P_{41}r_{13}P_{53} = .17$	$P_{54} = .10$	.07
	Z_6(INST)	$P_{65} + P_{54}P_{65} + P_{42}r_{23}P_{63} +$ --- $= .42$	$P_{64} = .35$	.07
	Z_7(IOC)	$P_{74} + P_{54}P_{75} + P_{42}r_{12}P_{71} +$ --- $= .35$	$P_{74} = .24$	.11
	Z_9(GA)	$P_{94} + P_{74}P_{97} + P_{64}P_{96} +$ ------ $= .41$	$P_{94} = .11$	.30
Z_5(COM)	Z_6(INST)	$P_{65} + P_{53}P_{63} + P_{51}r_{13}P_{63} +$ --- $= .37$	$P_{65} = .27$	.10
	Z_7(IOC)	$P_{75} + P_{51}P_{71} + P_{52}P_{42}P_{74} +$ --- $= .49$	$P_{75} = .43$	.07
	Z_8(IOE)	$P_{85} + P_{65}P_{86} + P_{52}P_{82} +$ ------ $= .32$	$P_{85} = .19$	.13
	Z_9(GA)	$P_{95} + P_{75}P_{97} + P_{85}P_{98} +$ ----- $= .41$	$P_{95} = .12$	.29
Z_6(INST)	Z_8(IOE)	$P_{86} + P_{63}P_{83} + P_{65}P_{85} +$ ------ $= .25$	$P_{86} = .09$	.16
	Z_9(GA)	$P_{96} + P_{86}P_{98} + P_{65}P_{96} +$ ------ $= .68$	$P_{96} = .50$	.13
Z_7(IOC)	Z_9(GA)	$P_{97} + P_{75}P_{95} + P_{74}P_{94} +$ ------ $= .57$	$P_{97} = .09$	.48
Z_8(IOE)	Z_9(GA)	$P_{98} + P_{86}P_{96} + P_{85}P_{95} +$ ------ $= .38$	$P_{98} = .15$	.23

2. Variable Z_2 (facility) was specified theoretically to have a direct effect on variable Z_9 (goal attainment) but the actual computation of the direct effect shows that the amount of the effect is as low as .01 yet its indirect effect, equal to .26, is quite significant. Similarily variable Z_3 (representation) has a negative direct effect of -.03 on variable Z_9 (goal attainment) but it has a larger amount of indirect effect of .30 that offsets its negative value of direct effect.

3. One very interesting result is that the direct effect of variable Z_7 (IOC) on variable Z_9 (GA) has a small value of .09, which is insignificant by t-test. However, its indirect effect on variable Z_9 has a value as high as .48. It is quite a contrast between direct and indirect effect. Had the evaluation of an independent variable been solely based on direct effect, variable Z_7 would be dropped. On the other hand, if one takes into account the indirect effect in the causal model, a researcher should retain variable Z_7 (IOC) in the model, this is what the author will do in determining the final path model. Under this situation the author examined the correlation matrix in Table 5.1 for better understanding of the phenomena. It shows that the correlation coefficient between variable Z_7 (IOC) and other variables in the model are: $r_{74} = .35$, $r_{75} = .49$, $r_{76} = .62$ and $r_{78} = .54$, since all of these values are relatively significant, and each of these variables was assumed to have a direct effect on variable Z_9 (goal attainment). These lead to the conclusion that the direct effect of variable Z_7 on variable Z_9 is by way of its correlation with variables Z_4, Z_5, Z_6 and Z_8.

4. The column of "total effect" consists of direct effects (elementary paths) and some indirect effects (compound paths) and gives some information about the elements of total effects. These elements provide valuable resources for interpreting direct and indirect effects on the postulated causal scheme. Tracing connecting paths discussed in Chapter IV is one technique to obtain these elements in the equations. In case of some doubt about the tracing technique one should expand these equations by the basic theorem of path analysis.

The final model

It is the author's thinking that the purpose of an empirical research is to validate and/or to improve the theoretical knowledge from which the researcher's conceptualization was formulated prior to the empirical analysis of the data. Thus, the author reexamined the nine insignificant paths which were specified, originally based on theory, but were dropped after significance test by t-test. As a matter of fact, these three path coefficients of P_{86}, P_{54}, P_{97} have t values of 1.32, 1.55 and 1.28 respectively that are very close to the significant level. Moreover, these three variables are theoretically important. Judging from these facts, the author proposes to retain these three path coefficients and their paths in the final model, and to indicate them by a symbol of "T" such that they can be distinguished from the actually statistically significant paths.

In sum, the final causal model, based on the theoretical knowledge from sociology and the results of these empirical data, contains 15 paths and eight independent variables which can be grouped into two categories.

The first category includes variable Z_1 (size), Z_2 (facility) and Z_3 (representation), and all these three are considered as prior conditions and/or environments for the local civil defense organizations. The second category includes variable Z_4 (complexity), Z_5 (communication), Z_6 (institutionalization), Z_7 (intraorganizational coordination) and Z_8 (interorganizational relations) which are related to organizational "actions" and/or the process of organizational decision-making. From the final model, the author finds that there exists no paths leading from these three "conditional" variables directly to the organizational goal attainment, and paths lead directly from all "organizational actions" variables to the organizational goal attainment. These interesting results can be interpreted as follows: organization's prior conditions, such as population size, amount of budget, and memberships with other formal organizations, are crucial in affecting organizational decision-making and/or organization actions directly. But their effects on the organizational goal attainment are felt rather indirectly through the process of decision-making or organizational actions. On the other hand, any organizational decision-making or actions, which are affected or limited by its prior conditions, will have direct effect on the achievement of organizational goal(s). The interpretation of the model seems very logical and fits into existing organizational theory.

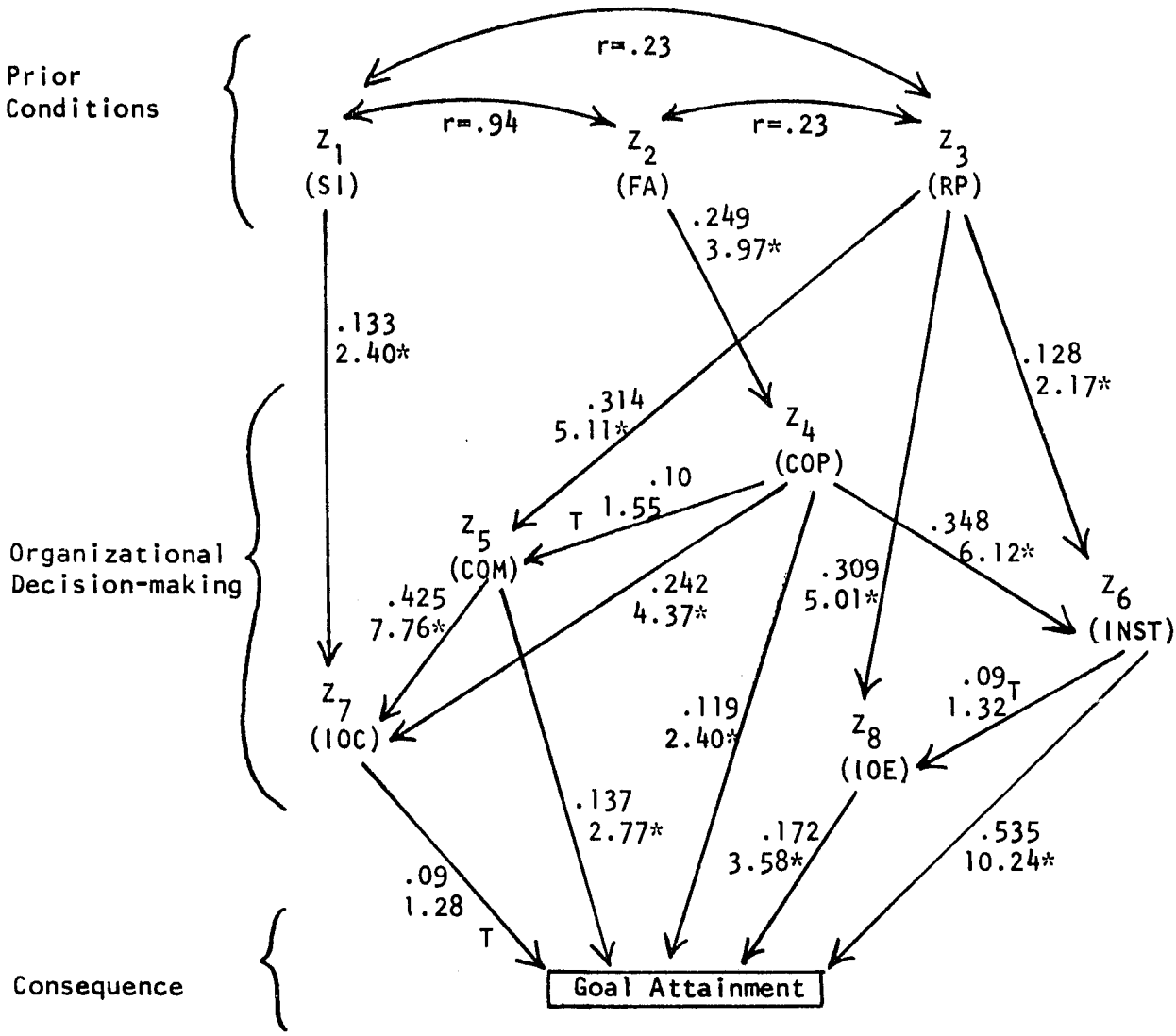
Another advantage of the model, in addition to the above meaningful interpretation, is in terms of their time sequence of these variables. As discussed in the methodological chapter, time sequence is a criteria in establishing causal relationships between variables. These prior organizational conditions were set up in the early period or in the "past," and their appearance in the model should come earlier than other variables.

Organizational decision-making or actions concern "present" organizational practice, and the consequences of these actions or decision-making will be on organizational goals which is the desired state to be achieved in the "future." Thus, the establishment of cause and effect relationships specified in the model quite agree with the past, present and future time sequence--a criteria in determining causal orderings in a theoretically formulated causal model. In conclusion, the author asserts that the final model shown in Figure 5.4 is a logically and theoretically acceptable causal model.

The author would like to make a last note about the evaluation of path models. There are two models presented in this section; the first model shown in Figure 5.3 was obtained by a preliminary t-test of significance on the theoretically formulated causal model. The second model was derived by adopting theoretical knowledge from the substantive field and the results of the present test of significance into the first model. Once the first model was modified by theoretical knowledge, the resultant model was moved into an unspecified situation. In consequence, the second model needs to be empirically tested in another research study.

Search for the Best Set of Explaining Variables

In the present study there are 14 variables that can be used as independent variables to explain and/or predict the variability of official goal achievement of local civil defense organizations. In order to maximize the explaining capacity and/or predictive ability in the final regression model, Draper and Smith (1966) have indicated that a researcher may use as many independent variables as possible. On the other hand, a researcher



*Significant at five percent level by two-tails test

TTheoretical importance and nonsignificant but close

Figure 5.4. The final causal model

may need to eliminate theoretically unimportant or empirically insignificant variables to reduce the cost of labor involved in the process of analysis. The compromise between these two extremes is to search for a best set of explaining variables.

In general, searching for the best set of explaining variables depends on several conditions such as model specifications, the nature of variables, the order of entering variables into the regression equation, and the statistical methods used. In the following pages the author shall consider three kinds of model specifications, and apply the three different regression procedures of forward, backward deletion and stepwise techniques to derive a best set of explaining variables under the above three model specifications.

Completely specified model

Bancroft (1964) argues that if no attempt is made to use the data in hand as an aid in determining the model specification to be used in subsequent inferences, the analysis is referred to as being determined by a completely specified model. In the case where no aid is made from the data, an investigator must specify the exact number of variables to be included, the order of these variables to be entered, the functional relationship between the variables entered, and some additional assumptions on the properties of error terms before actual data analysis.

Adapting Bancroft's idea to the present study, the author specified, from organizational theory and from verified theoretical information in the field, that the eight independent variables included in the above causal model is a best, sufficient set of variables to explain and to predict the

variability of official goal achievement of local civil defense organizations, and their effects on the dependent variable are linear and additive in nature. Then, the author made use of ordinary regression analysis to the empirical data to search for a best set of independent variables under the above model specifications. Mathematically, the regression model can be written as:

$$X_9 = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + e$$

Where B_0 and B's are parameters,

X_9 is the dependent variable, i.e., the official goal achievement,

X_i's are those independent variables used in the theoretically formulated causal model, i.e., size, facility, representation, complexity, communication, institutionalization, intraorganizational coordination and interorganizational relation respectively, and

e is an error term and is assumed to be NID(0, 1).

Since those conditions for searching a best set of explaining variables are completely specified prior to data analysis, ordinary multiple regression procedures can be applied to solve these B's in the above equation. The results of the regression analysis is shown in the last part of Table 5.11. In addition to the results, the author completed seven other regression runs separately, starting with variables Z_8, and then added Z_7, Z_6, Z_5, Z_4, Z_3, Z_2, Z_1 successively so that these results of regression analysis provide a more clear picture in indicating how each independent variable contributes to the explanation of the variability of official goal achievement of local civil defense organizations. Table 5.11 contains the final

Table 5.11. Analysis of variance of goal attainment under the completely specified regression model

Independent Variables	Regression Coefficient	t Value	Regression Mean Sq.	Residual Mean Sq.	F-ratio	R-square
Constant	-330.25					
X_8(IOE)	17.25	6.25	8714898.55	223127.87	39.06*	.1409
Constant	483.87		10161593.00			
X_7(IOC)	9.26	8.14		175089.22	58.03*	.3288
X_8(IOE)	4.59	1.59				
Constant	122.67					
X_6(INST)	53.49	9.45				
X_7(IOC)	2.45	2.02	10572257.66	127553.22	82.89*	.5131
X_8(IOE)	7.57	3.04				
Constant	29.71					
X_5(COM)	2.16	2.24				
X_6(INST)	52.23	9.26	8086275.03	125422.26	64.48*	.5232
X_7(IOC)	1.67	1.34				
X_8(IOE)	7.08	2.85				
Constant	90.84					
X_4(COP)	2.37	2.32				
X_5(COM)	2.22	2.33				
X_6(INST)	48.34	8.28	6601251.68	123132.79	53.61*	.5339
X_7(IOC)	1.48	1.20				
X_8(IOE)	6.57	2.66				

Table 5.11. (Continued)

Independent Variables	Regression Coefficient	t Value	Regression Mean Sq.	Residual Mean Sq.	F-ratio	R-square
Constant	74.95					
X_3(RP)	-3.93	-0.61				
X_4(COP)	2.40	2.34				
X_5(COM)	2.30	2.38	5508755.49	123462.66	44.62*	.5346
X_6(INST)	48.43	8.28				
X_7(IOC)	1.61	1.28				
X_8(IOE)	6.87	2.73				
Constant	74.67					
X_1(SI)	0.79	-0.02				
X_3(RP)	-3.92	-0.60				
X_4(COP)	2.41	2.32				
X_5(COM)	2.30	2.37	4721797.71	123994.60	38.08*	.5346
X_6(INST)	48.44	8.22				
X_7(IOC)	1.61	1.27				
X_8(IOE)	6.87	2.72				
Constant	82.59					
X_1(SI)	-0.001	-0.85				
X_2(FA)	0.01	0.90				
X_3(RP)	-4.08	-0.62				
X_4(COP)	2.36	2.27	4144211.38	124093.68	33.40*	.5363
X_5(COM)	2.32	2.40				
X_6(INST)	47.16	7.78				

Table 5.11. (Continued)

Independent Variables	Regression Coefficient	t Value	Regression Mean Sq.	Residual Mean Sq.	F-ratio	R-square
X_7(10C)	1.73	1.36				
X_8(10E)	6.81	2.63				

outcome of these analysis of variance for each individual regression equation and regression coefficients (B's) in each run. These regression runs reveal an interesting result: though each analysis of variance of individual regression equations had proved significant at the .05 probability level by F test, the equation containing variable Z_6, Z_7 and Z_8 is an economical set of variables in explaining relative amounts of variations in the dependent variables. These three variables as a set of independent variables alone had accounted for more than 51 percent of variance in the model, as indicated by the value of R square. A close examination of those successive regression runs shows that when additional variables are entered little is gained in explaining unexplained portions of variance after the above three variables have been included in the equations. However, the completely specified model still looks quite reasonable since it has support from theoretical knowledge and agrees with past investigations in the field, also, these eight variables did account for more than 53 percent of the total variance in the dependent variable. The final regression equation with estimated B_i's under the completely specified model can be written as:

$$X_9 = 82.59 - 0.93X_1 + 0.54X_2 - 4.08X_3 + 2.36X_4 + 2.32X_5 + 47.16X_6 + 1.73X_7 + 6.81X_8$$

Incompletely specified model

In the application of regression analysis to specific data, a researcher may have some doubt as to the exact number of variables to be included, and/or some doubt about the linearity and additivity of the variables' effects, especially in some new area of research. Under these circumstances, Bancroft (1964) proposes to make use of data in hand to determine the final model, and defines this procedure of analysis as the analysis on incompletely specified models involving the use of preliminary test(s) of significance in which a researcher uses the data on hand to calculate a test of significance as an aid in determining the final model (Bancroft, 1964).

Based on prior knowledge from the discipline and previous data analysis, the author asserts that the eight variables included in the above causal model are a basic, necessary set of variables in explaining variable X_9 (goal attainment) even though some of these independent variables have insignificant t's. Moreover, the additional six variables discussed in Chapters II and IV should be examined in order to determine their usefulness in explaining the variability of official goal achievement of local civil defense organizations. In addition, linearity and the importance of these six additional variables were specified. The order of entering these six variables was specified before the regression runs on the basis of theoretical importance and their simple correlation coefficient with the dependent variable (goal attainment). For example, the author considered variable X_{10} as of the most theoretical importance and it has a correlation coefficient of .4007. Thus, the variable was specified as the first variable to be entered. Another example is variable X_{11} (sanction), which was specified to be entered second, since the variable has the highest correlation with

the dependent variable (r = .5894) and mild importance in terms of theoretical aspects. In short, these six variables were specified in advance to enter into regression equations in the following order: socialization, sanction, morale, selectivity, norm and spatial distribution (ecology). The only uncertainty in the present regression analysis is that the author made no definite decision as to the exact number of variables which should be included. Under this model specification, the forward regression procedure was employed to determine the final model. In the process of the forward regression procedure, variable X_{10} (socialization) was the first variable, in addition to the above eight variables, entered into the regression equation, and then analysis of variance was performed on the new regression equation which had a total of nine independent variables in it. If the F-test is not significant at the five percent probability level, i.e., 2.96, then the last variable entered (socialization in the present study) is dropped and the forward regression procedure terminated. On the other hand, a significant F-test indicates that the last variable entered shall be retained in the following equation, and the next variable to be entered is variable X_{11} (sanction), X_{12} . . ., etc. The process goes on until a nonsignificant F test is reached. Since the outcome of the first regression was a nonsignificant F value, the variable X_{10} was dropped and forward regression terminated immediately. Thus, the final regression model based on the incompletely specified model contains the same eight independent variables as in the completely specified model, and the numerical values for the analysis are exactly the same as shown in the last row of Table 5.11.

In order to further examine these additional six variables, the author employed backward sequential deletion procedures to analyze the model specification again. The procedure first performed the analysis of variance on the equation in which all the 14 independent variables were entered. If the F test is not significant at the five percent probability level, then the variable in the last order (that is, space distribution in the present study) shall be dropped. Then the remaining 13 variables shall be entered again, and the analysis of variance shall be carried out again on the new equation. These procedures continue until a significant F value is reached. The outcomes of the backward deletion procedure are shown in Table 5.12, in which regression coefficient, t values, F ratio and R square are summarized. The backward deletion procedure eliminated four out of the six additional variables. These are variables of spatial distribution, norms, selectivity and morale. The final regression model with estimated B's by the procedure can be written as follows:

$$X_9 = -36.43 + 0.01X_2 - 3.4X_3 + 2.32X_4 + 1.18X_5 + 35.33X_6 + 0.63X_7 + 6.76X_8 + 6.70X_9 + 20.08X_{11}$$

Notes should be made between the forward and backward regression procedures used in the present study and in Draper and Smith's text (1966). The forward procedure discussed by Draper and Smith enter the first variable having the highest correlation with the dependent variable. If a significant test of the first variable is obtained, the next variable to be entered into the equation would be the one with the highest partial correlation coefficient. The forward procedures by Draper and Smith continue until the last variable entered is nonsignificant. The backward procedure presented

Table 5.12. The results of the backward regression analysis based on incompletely specified model

Dependent Variable	Independent Variable	Regression Coefficients	T Values	F-ratio	R-square
X_9(GA)	X_1(SI)	-0.0012	1.4262	22.43*	.5825
	X_2(FA)	0.0085	-1.1327		
	X_3(RP)	-2.8890	-0.4608		
	X_4(COP)	2.4385	2.3599		
	X_5(COM)	0.7772	0.7766		
	X_6(INST)	31.7836	4.7236		
	X_7(IOC)	0.6773	0.5395		
	X_8(IOE)	6.4027	2.6189		
	X_{10}(SOC)	7.0529	1.3337		
	X_{11}(SNT)	19.7985	4.3210		
	X_{12}(MOR)	1.0792	0.5315		
	X_{13}(SLT)	9.5615	0.4926		
	X_{14}(NOM)	2.4456	1.5391		
	X_{15}(SPC)	-0.0165	-0.7024**		
	Constant	-207.791			
X_9(GA)	X_1(SI)	-0.0011	-1.0519	24.17*	.5816
	X_2(FA)	0.0077	1.3209		
	X_3(RP)	-3.2169	-0.5152		
	X_4(COP)	2.2491	2.2573		
	X_5(COM)	0.7702	0.7706		
	X_6(INST)	31.8446	6.7384		

*Significant at .05 level of F-test.
**Not significant at .05 level of t-test.

Table 5.12. (Continued)

Dependent Variable	Independent Variable	Regression Coefficients	T Values	F-ratio	R-square
	X_7(IOC)	0.6311	0.5039		
	X_8(IOE)	6.3925	2.6177		
	X_{10}(SOC)	7.3329	1.3921		
	X_{11}(SNT)	20.0036	4.3796		
	X_{12}(MOR)	0.9890	0.4886		
	X_{13}(SLT)	8.0235	0.4165		
	X_{14}(NOM)	2.4291	1.5306**		
	Constant	-203.551			
X_9(GA)	X_1(SI)	-0.0012	-1.0851	25.83*	.5773
	X_2(FA)	0.0079	1.3536		
	X_3(RP)	-3.4918	-0.5578		
	X_4(COP)	2.3130	2.3166		
	X_5(COM)	1.0716	1.0903		
	X_6(INST)	34.0192	5.1638		
	X_7(IOC)	0.6076	0.4838		
	X_8(IOE)	6.5800	2.6900		
	X_{10}(SOC)	5.7889	1.1165		
	X_{11}(SNT)	19.8869	4.3418		
	X_{12}(MOR)	1.1586	0.5716		
	X_{13}(SLT)	10.9924	0.5718**		
	Constant	-65.3077			
X_9(GA)	X_1(SI)	-0.0011	-1.0553	28.24*	.5767
	X_2(FA)	0.0078	1.3462		

Table 5.12. (Continued)

Dependent Variable	Independent Variable	Regression Coefficients	T Values	F-ratio	R-square
	X_3(RP)	-3.2896	-0.5271		
	X_4(COP)	2.3206	2.3278		
	X_5(COM)	1.1064	1.1295		
	X_6(INST)	34.5584	5.3080		
	X_7(OC)	0.5792	0.4622		
	X_8(IOE)	6.6463	2.7241		
	X_{10}(SOC)	6.2326	1.2175		
	X_{11}(SNT)	19.8247	4.3359		
	X_{12}(MOR)	1.2075	0.5971**		
	Constant	-57.1946			
X_9(GA)	X_1(SI)	-0.0011	-1.0114	31.11*	.5760
	X_2(FA)	0.0075	1.2948		
	X_3(RP)	-3.3978	-0.5454		
	X_4(COP)	2.3235	2.3340		
	X_5(COM)	1.1780	1.2135		
	X_6(INST)	35.3294	5.5442		
	X_7(IOC)	0.6303	0.5049		
	X_8(IOE)	6.7615	2.7840		
	X_{10}(SOC)	6.6950	1.3249		
	X_{11}(SNT)	20.0847	4.4190*		
	Constant	-36.4316			

by Draper and Smith would first run the equation which includes all the variables, and then drop the variable having the lowest t value if it is not significant at a predetermined probability level. The backward procedure goes on until all variables in the equation are all significant. Thus, the forward and backward procedure used in the present study make use of sociological theory and the results of significance tests to select or determine variables in the final model, while the forward and backward model discussed by Draper and Smith select variables strictly based on the values of partial r's and t's. In consequence, the final equation derived by Draper and Smith's forward and backward procedures would include only those significant variables. But the final equation obtained in the present study included some variables which are not significant at the five percent probability level.

Unspecified model

In the following regression analysis the author made no particular specifications on the exact number of independent variables or the basic set of variables to be included in the regression equation, and no assumptions were made on the order of entering variables into each run. In this case the uncertainty on the final model shall be determined solely by statistical theory and the quality of empirical data. The stepwise regression procedure is a statistical method which may be used in analyzing the empirical data under this circumstance, since in the process of stepwise regression statistical theory provides guidance as to the order of entering variables, the criteria of rejecting or retaining a specific variable in the equation, and to derive the final regression model. Since this procedure takes into account theoretical knowledge from the discipline only in

determining the original variables to be considered, and only makes use of tests of significance and R squares in assessing the final model, the author shall call it unspecified model.

The analysis of variance of each run based on the stepwise regression procedure produced Table 5.13 in which values of regression coefficients, F-ratio, partial F-to-remove and R squares are included. In addition, Table 5.14 indicates values of partial correlation, partial F-to-enter for those variables not entered in each regression run. The final model derived by the stepwise regression procedure consists of only four variables of X_6 (INST), X_{10} (sanction), X_8 (IOE) and X_4 (COP), and these four variables accounted for 56.37 percent of total variance in the variable X_9 (goal attainment). The final regression model with estimated B's can be expressed in the following final equation:

$$X_9 = 20.50 + 41.40X_6 + 21.97X_{10} + 8.18X_8 + 2.45X_4$$

The author found that, among the four variables in the final model, only variable X_{10} (sanction) was not included in any of the previous path models, and the amount of accounted variance is quite substantial and significant--that it was the second highest amount of variance accounted for in all models. Further discussion and comparison of these models are presented in the next chapter.

Table 5.13. Analysis of variance of goal attainment by stepwise regression based on unspecified model

Runs	Variables Entered	Regression Coefficients	F-ratio	Partial F-to-remove	R-square
Step 1	X_6(INST)	65.638	202.202	202.202	.4593
	Constant	974.101			
Step 2	X_6(INST)	49.022		83.857	
	X_{11} (SNT)	24.132	127.327	28.818	.5180
	Constant	836.907			
Step 3	X_6(INST)	45.889		77.207	
	X_{11} (SNT)	21.909	97.023	25.100	.5522
	X_8(IOE)	8.851		18.073	
	Constant	-58.488			
Step 4	X_6(INST)	41.398		57.180	
	X_{11} (SNT)	21.968		25.786	
	X_8(IOE)	8.174	75.894	15.477	.5637
	X_4(COP)	2.447		6.152	
	Constant	20.495			
Step 5	The stepwise procedure terminated due to no "F-value to enter" is larger than the required "F level to enter, i.e., 2.96." See Table 5.14.				

Table 5.14. Partial correlations and partial F values of those variables not in each stepwise regression run based on unspecified model

Runs and Variables entered	Variables not in equation	Partial Correlation	Partial F-value to enter
Step 1	X_2(FA)	0.06161	0.90326
X_6(INST)	X_1(SI)	0.05202	0.64319
	X_3(RP)	0.10681	2.7349
	X_4(COP)	0.18058	7.9888
	X_5(COM)	0.23366	13.687
	X_7(IOC)	0.25339	16.262
	X_8(IOE)	0.28940	21.664
	X_{10}(SOC)	0.18163	8.0849
	X_{11}(SNT)	0.32926	28.818
	X_{12}(MOR)	0.16017	6.2404
	X_{13}(SLT)	-0.09447	2.1345
	X_{14}(NOR)	0.13023	4.0890
	X_{15}(SPC)	0.03550	0.29910
Step 2	X_2(FA)	0.09265	2.0435
X_6(INST)	X_1(SI)	0.07155	1.2144
X_{11} (SNT)	X_3(RP)	0.08579	1.7501
	X_4(COP)	0.18766	8.6143
	X_5(COM)	0.15832	6.0673
	X_7(IPC)	0.18964	8.8042
	X_8(IOE)	0.26671	18.073
	X_{10}(SOC)	0.14655	5.1798
	X_{12}(MOR)	0.10570	2.6667

Table 5.14. (Continued)

Runs and Variables entered	Variables not in equation	Partial Correlation	Partial F-value to enter
	X_{13}(SLT)	0.09309	2.0632
	X_{14}(NOR)	0.12856	3.9660
	X_{15}(SPC)	0.05639	0.75285
Step 3	X_2(FA)	0.06848	1.1075
X_6(INST)	X_1(SI)	0.04330	0.44768
X_{11} (SNT)	X_3(RP)	-0.00120	0.00034
X_8(IOE)	X_4(COP)	0.15973	6.1528
	X_5(COM)	0.10371	2.5550
	X_7(IOC)	0.06976	1.1492
	X_{10}(SOC)	0.10679	2.7109
	X_{12}(MOR)	0.06323	0.94341
	X_{13}(SLT)	0.06516	1.0016
	X_{14}(NOR)	0.11169	2.9686
	X_{15}(SPC)	0.26173	0.16109
Step 4	X_2(FA)	0.05034	0.59467
X_6(INST)	X_1(SI)	0.02648	0.16420
X_{11} (SNT)	X_3(RP)	-0.00972	0.02209
X_8(IOE)	X_5(COM)	0.10689	2.7047
X_4(COP)	X_7(IOC)	0.06060	0.86267
	X_{10}(SOC)	0.10678	2.6990
	X_{12}(MOR)	0.06416	0.96752
	X_{13}(SLT)	0.06176	0.89583

Table 5.14. (Continued)

Runs and Variables entered	Variables not in equation	Partial Correlation	Partial F-value to enter
	X_{14}(NOR)	0.10714	2.7170
	X_{15}(SPC)	-0.01988	0.09248

CHAPTER VI. IMPLICATIONS

Implication for Real World Problems

As stated in the introductory chapter, one of the general objectives of the present study is to analyze those relationships between structural characteristics of civil defense organizations and the degree to which they contribute toward achieving official goals. The ultimate goal of the civil defense program is to protect and shelter civilian populations and help with recovery in the event of nuclear, natural or man-made disasters. In order to achieve the ultimate goal, routine preparations for these unpredictable disasters are an indication of official goal attainment of a local civil defense organization. This is the reason why the seven task areas were empirically measured in the present study to indicate the degree of official goal attainment since these seven task areas are preparatory in nature.

Factor analysis on the seven tasks' scores supported the unidimensionality of these seven measures. The implication of the result is that scores for these seven tasks measured only one concept (goal attainment in the present study) rather than some combination of concepts. Moreover, the correlation matrix of the 15 variables shows an obvious fact, that is, the larger the population size within a local civil defense area, the larger the amount of budget of the local civil defense unit.

Implications derived from the final path model are manifold. First of all, since scores on variable X_6 (institutionalization) were measured in two parts, that is, the establishment of a program paper and the relative increase of resources, the most influential factors that lead to the official

goal achievement of local civil defense organization is the establishment of a program paper and the relative increase in resources including budget, personnel and office space. A program paper is a management and planning document which records previous civil defense accomplishments and the projected activities of a local civil defense unit for the immediate future. Even though scores of official goal achievement may be partly the reproduction of those recorded previous accomplishments of a local organization, it is still logical and reasonable to state that improving the practice of program paper results in the advancement of official goals.

It seems, at first glance, quite unreasonable that the amount of current budget (variable Z_2 in the path models) did not have a direct effect on institutionalization which was measured partly by relative increase in resources. The author's interpreation is that a "pure" larger amount of current budget does not always imply a relative increase in resources since, regardless of the larger amount of current budget, it is possible that a local civil defense organization had a smaller current budget than the previous year. Consequently, it is possible that these relative increases in resources had greater effect on official goal achievement than a "pure" larger amount of budget. This may involve a psychological effect on local civil defense organizations' personnel, and the relative increase in resources served as strong incentive or motivation. In short, on the basis of above discussion, the recommendations to those authorities holding positions on the federal bureaucratic levels are of two aspects: (1) one of the most effective ways to improve civil defense official goals is to promote the establishment and presence of a program paper, either through close bureaucratic supervision or by increasing material assistance or incentives

to local units. In doing so it not only increases vertical communication between federal and local civil defense organizations but also serves as a regular reminder or note to the local civil defense units to advance the official goal; (2) yearly increasing resource assistance is another effective way to better achieve official civil defense goals. Regardless of the size of a small amount of increase, the emphasis is on "increase" but not necessarily large amounts of increase to serve as fresh psychological incentive or motivation.

Another implication from the path analysis is the widened membership of formal organizations within a local civil defense area has the broad effect of improving communication with nearby local civil defense personnel, working with formal organization, and establishing a local civil defense unit as a legitimated system. This suggests to the director and/or personnel of a local civil defense organization that an effective way to advance official goals, which they can easily do, is to extend their membership with other formal organizations within their local civil defense area since through the effect of the above three factors it will indirectly result in better official goal attainment.

The outcomes of regression analysis provide some valuable information with regard to the understanding and predicting of official goal attainment of civil defense organizations. To establish a program paper and relative increase in resources, to work with other formal organizations within a local civil defense area, to provide better civil defense training to its personnel are the three most influential factors in explaining and/or predicting the variability of achievement of civil defense goals. Another way of saying if it, given the information about the above factors, we can

predict quite accurately the degree of achievement of civil defense official goals.

Implication for Sociological Inquiry

Empirical social researchers attempt to study certain particular sociological problems for the purpose of deriving general principles and suggesting innovations in research methods to further the ability and capacity of the discipline to explain and/or predict sociological phenomena. The author initiated the present study in the hope that the results of these analyses would contribute something not only to real world problems but also to methodology and organizational theory as well. In the following pages some implications derived from the present study for sociological theory and further organizational investigations will be discussed.

An organization is a complex social system having many elements and dynamic processes in which these elements interact and function together. In addition to the complex structures of organization itself, there are varieties of organizations that are different in their structures, goal(s), social conditions and physical environment. The classic two variable analyses can no longer cover the complexity and variety of organizations. It seems obvious that multiple variable analysis, such as the present study, is a more appropriate approach in dealing with organizational study. Moreover, in order to cover the wide range of organizations, theory of organizations must remain at a relatively abstract level and employ relatively general concepts. Consequently, a researcher in studying organizations must construct more general indices measuring many aspects of these abstracted concepts, and utilize more sophisticated research methods to test the validity

of these indices and to handle the analysis of data. The implication derived from the factor analysis of seven task areas in the present study is that the technique is a useful tool to test the homogeneity of items which were theoretically constructed to measure different dimensions of an abstract concept. The technique not only provides a test of homogeneity of these items but also extracts a common factor from these original items as a general index for the concept(s) with which the researcher is concerned.

Implications from the results of path analysis in the present study are manifold. The author notices that construction of a valid causal model depends on the soundness and applicability of organizational theory. Also, the usefulness and meaningfulness of causal analysis rely on the validity of the theoretically formulated causal model. Regardless of these arguments, path analysis does provide valuable information about the indirect and direct causal relationships among the set of variables studied, and also furnishes relative magnitudes (coefficients) so that comparisons among these effects are possible. A specific implication from the final path model is that two categories of structural characteristics of organizations should be distinguished. Those structural characteristics (variables) related to organizational environment such as population size and facility, or social conditions such as representation to other formal organizations in the path model, belong to the first category. The second category includes those structural characteristics concerning organizational decision-making or actions such as communication, organization complexity, etc., in the path model. Interestingly enough this classification and its causal orderings in the present study seems to quite agree with existing organization theory.

Parsons (1963) has discussed the structure of organizations under three main headings: (1) mobilization of fluid resources--the primary adaptive exigencies of an organization concern the procurement of the resources, such as capital (budget), labor (population size), which are necessary for the organization to attain its goal or carry out its functions; (2) the mechanisms of implementation--once an organization obtains and controls the necessary resources, then it must have a set of mechanisms by which these resources can be brought to bear on the actual process of goal attainment; (3) institutional factors in the structure of organizations--these concern the compatibility of the institutional patterns under which the organization operates with those of other organization and social units. The first category of structural characteristics analyzed in the present study are equivalent to Parsons' institutional factors and the procurement of resources. The second category in the present study fits into Parsons' second headline. Note that variables of the first category appear earlier than the second ones. In conclusion, the agreement between the results of the present empirical analysis and Parsons' organizational theory provides a strong support to the final path model and insights for further organizational study.

A note should be made about the use of path analysis and regression analysis. Blalock (1967) points out that since path coefficients measure the actual amount of impact that each variable has on the others in a given population, they are more appropriate for those studies in which findings or results will be generalized to a specific population. On the other hand, unstandardized regression coefficients should be applied to determine whether or not a set of causal relationships are basically similar in different

populations. In the present empirical study, the final outcomes of path analyses are more appropriate in understanding these local civil defense organizations since generalization in the present study focuses on the same kind of population. Moreover, the final equations derived from regression analyses are better for predicting for different populations.

The regression analyses based on three different model specifications furnish three alternatives for any empirical study. When there is enough theory from substantive disciplines with regard to the subject matter under investigation, then the completely specified model is a proper approach for an empirical test of the theory applied. On the other hand, an unspecified model should be empirically strong and a more appropriate framework for an exploratory study in some new area of research. Between these two extremes is the incompletely specified model which may be a suitable model for the present stage of organizational studies since, at this stage of the discipline, sociologists have many viewpoints but few confirmed theories on organizations. By making use of the empirical data on hand, the analyses based on an incompletely specified model should be able to integrate those "loose theories or theoretical frameworks" and empirical relevances into stronger organizational theories.

In the closing pages of the present study, the author would like to point out that since no research method is perfect, and any research design is improvable, an empirical study should serve as an exploratory task for coming studies. Following these arguments, the author would like to indicate the weakness of the present study. The weakness is mainly in measurement problems. The reason for this is that the present study was initiated

after all measurements were made and data were obtained, and these imposed a limitation on the empirical analysis.

On the basis of the above limitations, the suggestions for conducting further studies are: (1) definition of theoretical concepts should be more precise such that operational definition of these concepts can be made more rigorously; (2) more general indices to measure organizational variables should be constructed. The method of factor analysis is very helpful in deriving these general indices; (3) other variables may be needed to improve the generality of the causal model.

CHAPTER VII. SUMMARY

Introduction

Based on the rationale that sociologists could and should allocate more attention and effort to the study of formal organizations at present stage of the discipline, the author made the present study of 240 local civil defense organizations. This sample of 240 organizations, which were the units of analysis in this study, was drawn from three states, Minnesota, Georgia and Massachusetts, during the summer of 1964.

The first general objective of the dissertation was to integrate existing organization theories used in the study of civil defense system and to apply factor analysis, regression procedures and path analysis technique to the empirical analysis of the structural characteristics and the goal attainment of these civil defense organizations. The second general objective of the dissertation was to establish a causal model based on the structural characteristics of local civil defense organizations in order to understand and explain the variable success of these organizations in achieving their official goals. The third general objective was to search for a best set of explaining variables and regression models on the basis of different model speicifications to predict the official goal attainment of civil defense organizations.

Organization Theory and Causality

Organizational theories, especially those related to the structural characteristics and goal attainment of organizations, were discussed. Formal organization is defined in the dissertation as "a social system which is

deliberately constructed and reconstructed to seek specific goals or values." (Phillips, 1969:116). A local civil defense organization was conceived of as a social system. Main assumptions underlying this viewpoint are: an organization has a set of interdependent parts; has needs for survival; and is able to take action. The nine elements, six master processes, and three conditions in the Loomis processually articulated structural model were reviewed in this section. The nine elements are "belief," "sentiments," "ends or goals," "norms," "status," "rank," "power," "sanction," and "facility." The six master processes are "communication," "boundary maintenance," "systemic linkage," "socialization," "institutionalization," and "social control." The three conditions in the PAS model are "territoriality," "size," and "time."

In addition to the above organizational theory, the five analytical approaches of the "human relation," "organizational psychology," "social-technical system," "decision-making theory," and "structural-functionalism" were discussed and summarized in one table. Moreover, three levels of organizational analysis classified by Scott were introduced. These three levels are behavioral, structural, and ecological. Of these, the structural analysis was employed by the author to analyze the structural characteristics of the 240 local civil defense organizations.

In introducing the notion of causation, the author discussed the notion from the perspectives of positivism, probabilistic model, and two variants of conceptualism. Auguste Comte stated that the concept of causality is a continuation of the experiencing mind and, therefore, should be excluded from the subject matter of sociology. The development of the probabilistic

model of contemporary statistics reformulates the concept of causality and provides a more realistic description of social phenomena. The first variant of causal thinking from conceptualism suggests substitution of mathematical functions for objective causal bonds and raises the question of which conceptual scheme provides a better fit to the factual world. The second variant of the conceptualist's causal thinking conceives of cause and effect as an attribute of the conceptual model itself. Thus, causal relationships can be ascertained by subjecting the model to logical or mathematical operations. The review of Simon-Blalock causal ordering was the extensive discussion on the second variant of conceptualist's causal thinking.

Formulation of Concepts and Conceptual Model

The author used the backward formulation procedure, in which the dependent variable appears in each of the successive steps to develop the general causal model of Figure 7.1.

Totally 15 concepts are defined, and their cause and effect relations are formulated. These 15 organizational concepts include "goal attainment," "interorganizational relations," "intraorganizational coordination," "communication," "institutuionalization," "complexity," "size," "facilities," "representation," "norms," "sanction," "selectivity," "socialization," "morale," and "ecology." Only the first nine concepts are included in the causal model being developed. The additional six concepts are for additional testings. The final causal diagram is shown in Figure 7.1.

Methodology, Data Analysis and Findings

The 15 concepts formulated in previous discussion were operationalized to develop the empirical measures of these concpets with respect to the

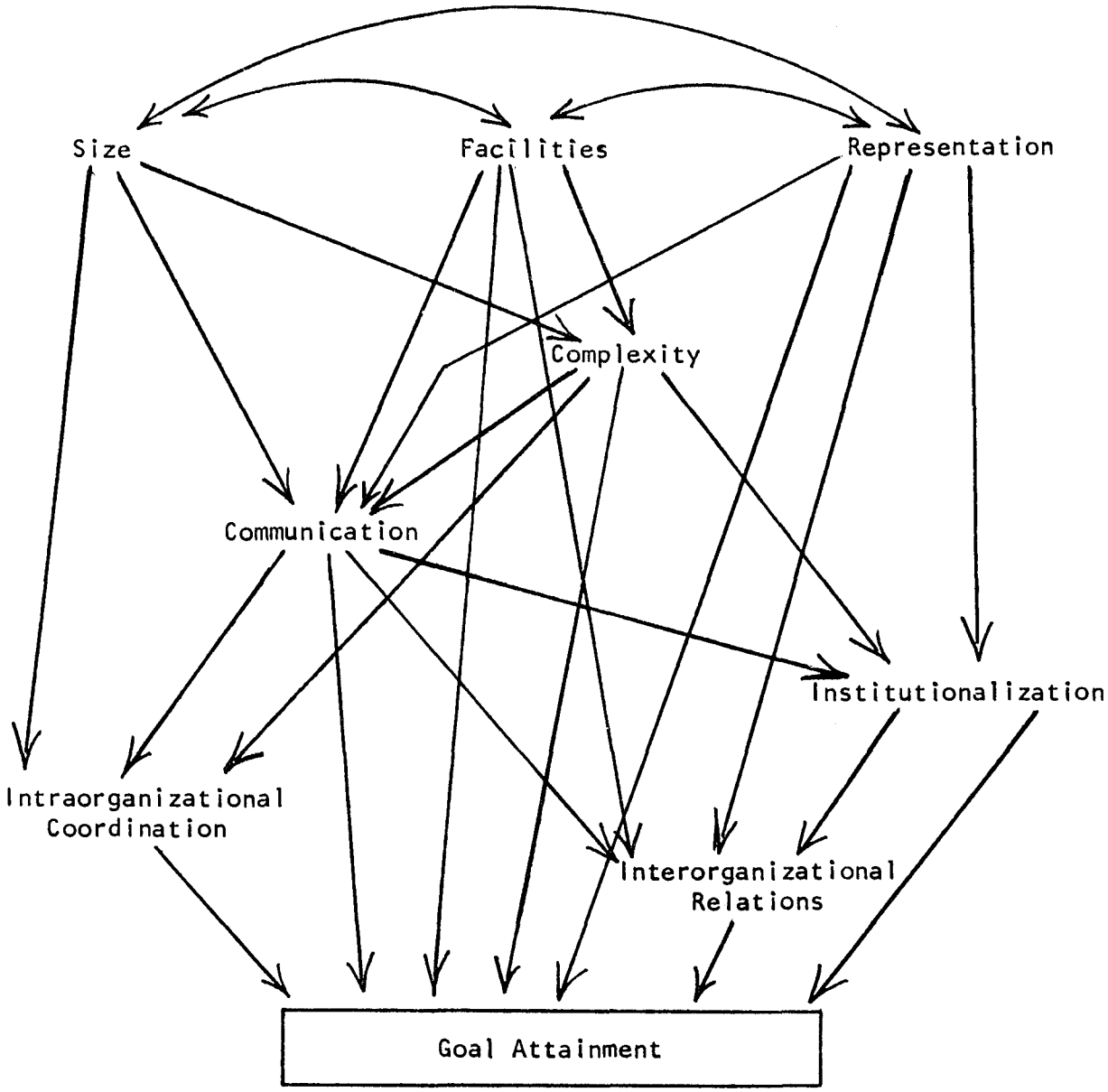
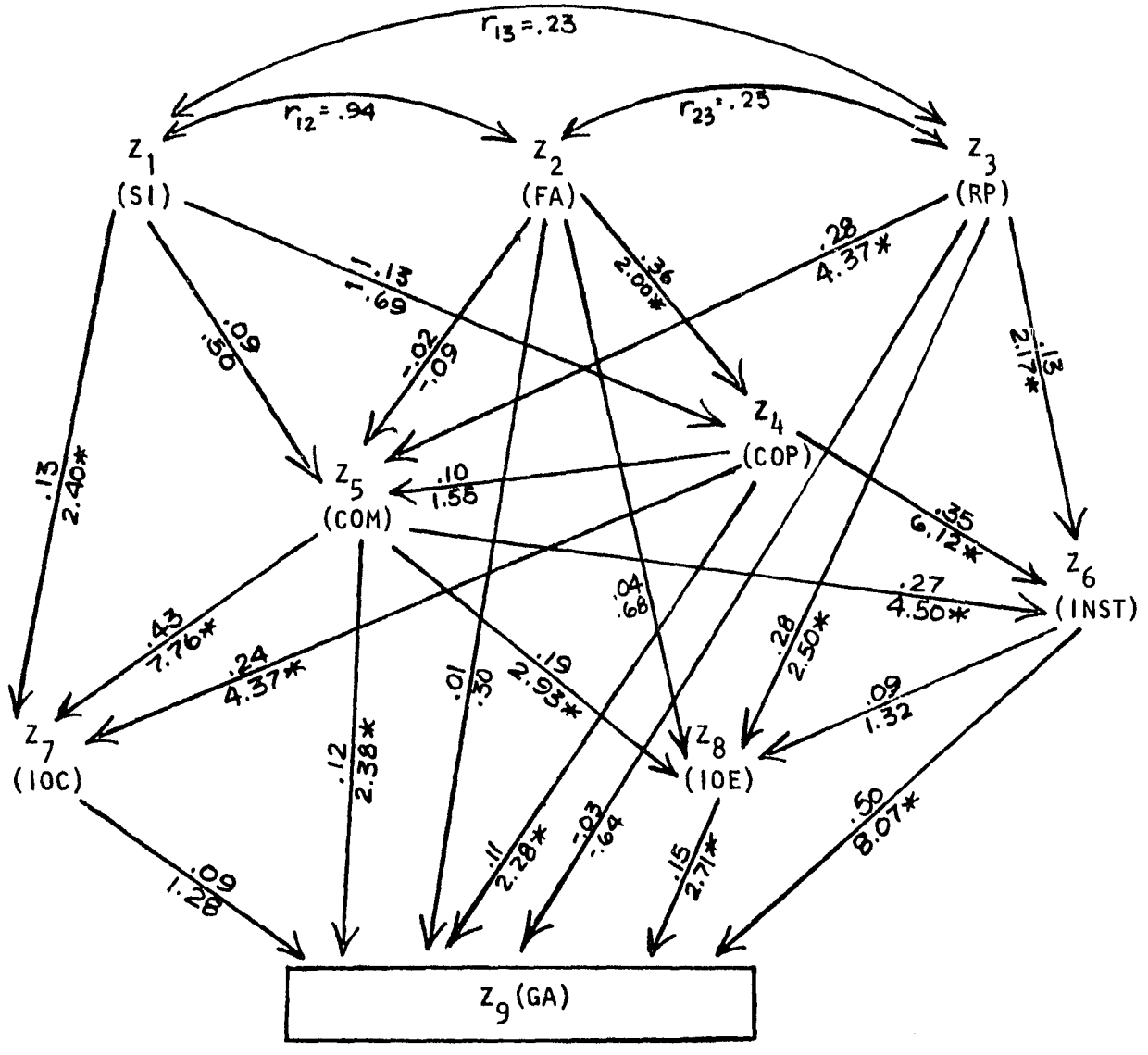


Figure 7.1. The theoretically formulated causal model

local civil defense organizations. The method of factor analysis and the technique of path analysis were presented and discussed on a general level for their later application to the data analysis.

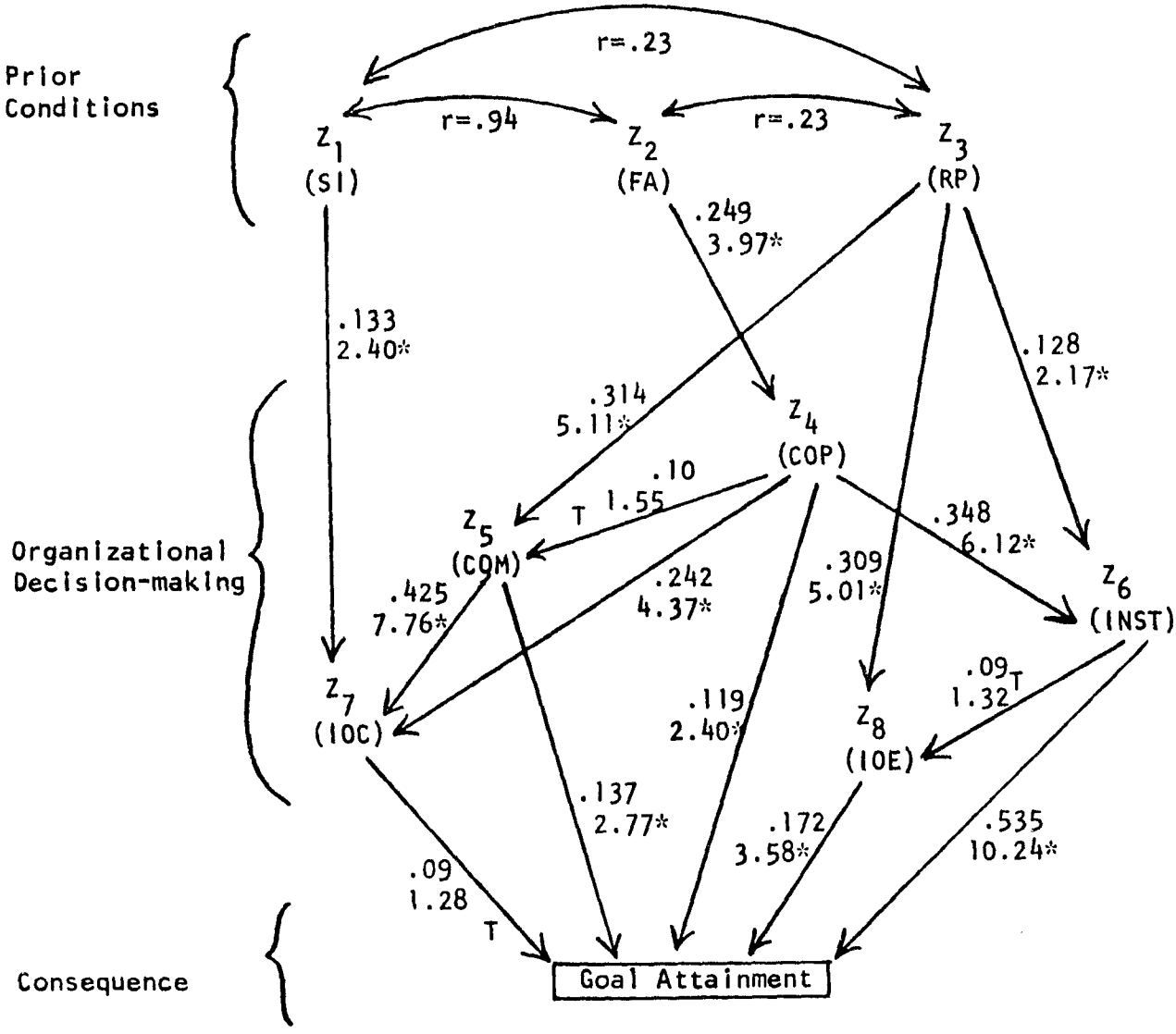
Both direct and stepwise solution were applied to the factor analysis of the seven task area scores measuring the dependent variable of goal attainment. In the direct solution the multiple-group centroid procedure based on the classical factor model was used to confirm the hypothesis about the existence of the general variable. In the stepwise solution, the principle axes method based on the principle component model was employed to condense variables, and Kaiser's varimax approach was used to rotate factors. The results of these two solutions support the hypothesis that these seven task area scores are quite homogeneous. That is, these seven scores measure only one concept. On the basis of the homogeneity of these seven scores, the author concluded that combining these seven empirical scores together to indicate the variability of the dependent variable is acceptable.

Values of path coefficients for those paths in the theoretically formulated path model were computed from the civil defense data. The results are presented and summarized in Figure 7.2. In the tests of significance of above path coefficients, nine paths were found insignificant at the five percent probability level. After reexamining the values of these nine insignificant path coefficients and taking into account existing organization theory, the author proposes a final model shown in Figure 7.3. Variables in the final model can be grouped into two categories: the first category includes variable Z_1 (size), Z_2 (facility), and Z_3 (representation) which are considered as prior conditions for the local civil defense organizations;



*Significant at .05 level by two-tails test.

Figure 7.2. The path model with path coefficients and T-values



*Significant at five percent level by two-tails test

TTheoretical importance and nonsignificant but close

Figure 7.3. The final causal model

the second category includes variable Z_4 (complexity), Z_5 (communication), Z_6 (institutionalization), Z_7 (intraorganizational coordination) and Z_8 (interorganizational relations) that are related to organizational "action" or the process of organizational decision-making.

Ordinary regression analysis of the eight independent variables under the completely specified model indicated that the eight variables of "size," "facility," "representation," "complexity," "communication," "institutionalization," "IOE," and "IOC" together explained 54 percent of the total variance in the dependent variable. Under the incompletely specified model, a final regression equation derived by the forward regression procedure provided an equation which is exactly the same as the previous equation under the completely specified model. Moreover, the backward regression procedure under the incompletely specified model eliminates four out of the six additional variables. These eliminated variables are "spatial distribution," "norms," "selectivity," and "morale." As compared with the final regression equation under the completely specified model, the final regression equation developed by the backward procedure under the incompletely specified model has two more variables (socialization and sanction) than above equations, and these ten independent variables together explained 57.6% of total variance in the dependent variable.

The stepwise regression analysis of the 15 variables under the unspecified model produced a final equation with only four variables included. These four variables are X_6 (institutionalization), X_{10} (sanction), X_8 (IOE) and X_4 (complexity). These four variables alone accounted for 56.37 percent of total variance in the dependent variable of goal attainment.

Implication

Implications for real world problems from the present study are as follows. (1) one of the most effective ways to improve civil defense official goals is to promote the establishment and presence of program papers, either through close bureaucratic supervision or by increasing material assistances. Doing so not only increases vertical communication between federal and local civil defense organizations but also encourages the local civil defense units to advance the official goal. (2) Yearly increasing resource assistance is another effective way to achieve the official civil defense goals. (3) Widen memberships of formal organizations within a local civil defense area has a broad effect of improving communication with nearby local civil defense personnel, working with formal organization, and establishing a local civil defense unit as a legitimated system.

Some important implications for sociological inquiry from the present study are as follows. (1) The technique of factor analysis is a useful tool to test the homogeneity of original items which were constructed to measure different dimensions of an abstract concept. (2) Path analysis provides valuable information about the indirect and direct causal orderings among the set of variables, and also furnishes relative magnitudes or coefficients for the comparisons of these effects. (3) A distinction should be made between variables related to the organization's prior conditions and organizational decision-makings or actions. (4) Regression analyses based on three different model specifications furnishes three alternatives for empirical studies. When there is enough theory from substantive discipline about the subject matter under investigation, then the completely specified

model is a proper approach for empirical test of the theory applied. On the other hand, an unspecified model should be both empirically strong, an appropriate framework for an exploratory study in new areas of research. Between these two extremes is the incompletely specified model that may be a suitable model for present stage of organizational studies.

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APPENDIX A. THE NAMES OF 23 FORMAL ORGANIZATIONS

The concept of interorganizational relations was measured empirically in terms of the extent to which a local civil defense organization has worked with 23 formal organizations. The names of these 23 formal organizations are listed below:

1. Lions
2. Kiwanis
3. Rotary
4. Chamber of Commerce
5. Jr. Chamber of Commerce
6. Parent Teachers' Association (PTA)
7. Farm Bureau
8. National Farmers' Union
9. Grange
10. National Farmers' Organization (NFO)
11. Eagles
12. Elks
13. Moose
14. Odd Fellows
15. Masons
16. American Legion
17. VFW
18. American Veterans (Am Vets)
19. Knights of Columbus
20. Knights of Pythias
21. Church organizations
22. Womens' organizations
23. Business and professional organizations

APPENDIX B. THE NAMES OF 20 GROUPS OR ORGANIZATIONS

The concept of intraorganizational coordination was measured empirically in terms of the degree of working productivity and the strength of tie for future cooperation between a local civil defense organization and individuals from 20 groups of people. The names of these 20 groups are listed as follows:

1. State Civil Defense Office
2. Local Board of Welfare
3. Local Agriculture Extension Service
4. Local school superintendents

5. Local employment office
6. Local police force
7. Local fire department
8. Local business firms

9. Local veterinarians
10. Local transportation people
11. Local utility companies
12. Local units of the National Guard

13. Local county or municipal civil defense agency
14. County Board of Supervisors
15. Local clubs and social organizations
16. Local Chapter of the American Red Cross

17. State highway police
18. Local medical and health personnel
19. Soil conservation service
20. County (or city) civil defense directors

APPENDIX C. NORMS

The concept of "norms" was measured empirically in terms of understanding rules for federal financial assistance. To determine the degree of understanding rules for each local civil defense organization, a test of six possible requirements necessary for federal assistance was administrated to the director of a local civil defense unit. Of these six items, three were required and three were not required. The six items and the scores assigned for possible responses are indicated in the following:

Possible Requirements

1. At least one paid civil defense director
2. Evidence of legal organization
3. An acceptable program paper
4. Been designated as a target area
5. A state-approved basic civil defense operational plan
6. A state-approved shelter utilization plan

Items 2, 3 and 5 were actually requirements, while items 1, 4 and 6 were not. The responses of each director were scores as follows:

Responses		Points for Correct Items 2, 3 and 5	Points for Incorrect Items 1, 4 and 6
No, Certainty	5	00	16
No, Certainty	4	03	13
No, Certainty	3	05	11
No, Certainty	2	06	10
No, Certainty	1	07	09
Uncertain or don't know		08	08
Yes, Certainty	1	09	07
Yes, Certainty	2	10	06
Yes, Certainty	3	11	05
Yes, Certainty	4	13	03
Yes, Certainty	5	16	00

APPENDIX D. SANCTION

The concept of "sanction" was measured empirically in terms of the possible rewards or penalties to have a local civil defense plan. The score for the variable was composed of two sub-scores described in Part 1 and Part 2 below.

Part 1: As a measure of Part 1 of variable 25, all directors of local civil defense units were asked, "Would any item or items below be of benefit to you in having a state-approved civil defense plan?"

1. Increased authority
2. Increased funds
3. Additional equipment
4. Better organization and cooperation with civil defense efforts
5. Reassuring for people
6. Increased acceptance or interest by people
7. Increased protection for people

The points assigned for possible responses are outlined as follows:

	Part 1 Points
Federal financial assistance item mentioned, and ranked first most important	6
Federal financial assistance item mentioned, and ranked second most important	5
Federal financial assistance mentioned and ranked, but not ranked first or second most important	4
Plus one point for each of five other sanctions that could have been mentioned ..... possible up to	5 (additional points)

Part 2: Local directors who said their civil defense area had made substantial progress toward the establishment of a state-approved Basic

Operational Survival Plan were asked which of the following items were reasons for setting up the plan. They were also asked to rank the first and second most important reasons.

1. Required for federal financial assistance
2. Influence of Cuban crisis
3. Attain better organization
4. Conform to or facilitate the operation of a basic plan
5. Attain more knowledge of operation
6. Secure or facilitate the safety of the people
7. Secure government surplus properties
8. Pressure from county and state government

Directors' responses were scored in the following manner:

	Part 2 Points
Federal assistance mentioned, ranked first most important	6
Federal assistance mentioned, and ranked second most important	5
Federal assistance mentioned, but not ranked first or second most important	4
Plus one point for each of seven other sanctions that could have been mentioned ..... possibly up to	7 (additional points)

APPENDIX E. SELECTIVITY

The concept of "selectivity" was measured by the following two questions:

1. About how many people other than yourself were interested in obtaining this (director) position?

Points assigned for possible responses are according to the following rules:

0 = Don't know
1 = None
2 = A few
3 = Several
4 = Many

2. Some people use the term "selectivity" to mean care, consideration, etc., in hiring or appointing people to positions. About how much "selectivity" do you feel was used in choosing you for this (director) position?

Points assigned for possible responses are indicated as follows:

0 = Don't know
1 = None
2 = Some
3 = Much

Total score for the variable is obtained by adding together the above two sub-scores.

APPENDIX F. SOCIALIZATION

Socialization was measured empirically by the following four items.

Socialization score items

1. How would you describe the amount and adequacy of the "job orientation" that you received from local governing bodies (Mayors, Board of Supervisors, etc.) prior to or right after accepting this position?

2. How about your job orientation from other local civil defense directors in your area of the state?

3. How about your job orientation from state civil defense officers or representatives?

   Code (for Q. 1, 2 and 3)

   0 = Don't know
   3 = I received little or no orientation
   6 = I received some (an incomplete orientation)
   9 = I received a great deal of orientation

4. With regard to your knowledge and understanding of your own responsibilities and commitments, as a local civil defense director which statement best describes your present feeling?

   Code

   0 = Don't know
   0 = I understand no more than I did when I accepted this position
   3 = I understand very little about my role and responsibilities
   6 = I somewhat understand my role and responsibilities
   9 - I thoroughly understand my role and responsibilities

Total score (Sum questions 1 - 4)